DIV. OF FISHES

604-A

COMMERCIAL FISHERIES Review

VOL 32, NO. 4 APRIL 1970

UNIVERSITY OF MICHIGAN
MAY 14 1970
MUSEUMS LIBRARY

MUSEUM
SH
11
.A47
Vol 32
No. 4

COVER: Eskimo child playing at cockpit of skin-covered kayak on Nunivak Island, Alaska. Bubble gum is great prize to him. (Photo: E. P. Haddon)

COMMERCIAL FISHERIES

Review

A comprehensive view of United States and foreign fishing industries--including catch, processing, marketing, research, and legislation--prepared by the Bureau of Commercial Fisheries.

FISHERMEN'S MEMORIAL--GLOUCESTER, MASS.

Managing Editor: Edward Edelsberg

Production: Jean Zalevsky
Alma Greene

The Bureau of Commercial Fisheries and
The Bureau of Sport Fisheries and Wildlife
make up The Fish and Wildlife Service of
The United States Department of the Interior.

Throughout this book, the initials BCF stand
for the Bureau of Commercial Fisheries.

Address correspondence and requests to: Commercial Fisheries Review, 1801 North Moore Street, Room 200, Arlington, Va. 22209. Telephone: Area Code 703 - 557-4246.

Publication of material from sources outside the Bureau is not an endorsement. The Bureau is not responsible for the accuracy of facts, views, or opinions of these sources.

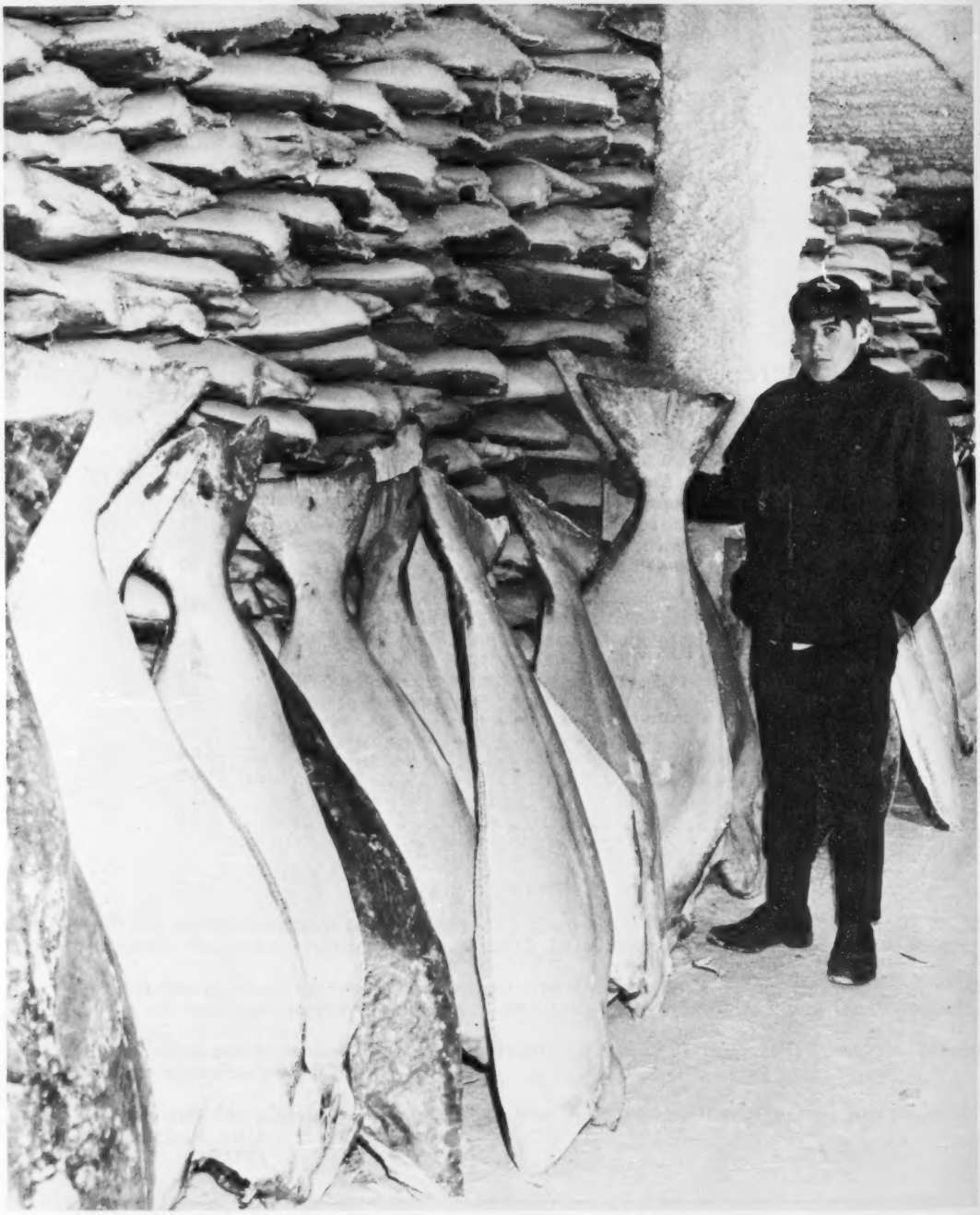
Although the contents have not been copyrighted and may be reprinted freely, reference to source is appreciated.

Use of funds for printing this publication was approved by the Director, Bureau of the Budget, April 18, 1968.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.
Price 60 cents (single copy). Subscription Price: $7.00 a year; $2 additional for foreign mailing.

CONTENTS

	Page
UNITED STATES	
Events and Trends	1
ARTICLES	
BCF Miami Scientists Study Florida Calico Scallops, by Ann Weeks	11
Surface Tuna Schools Located & Fished in Equatorial Eastern Pacific, by Thomas S. Hida	34
Night Lighting for Herring--An Old Technique May Have New Possibilities, by Alden P. Stickney	38
BOOKS	41
INTERNATIONAL	45
Canada	51
Europe	53
Latin America	57
Asia	59
Mid East	64
Africa	65
INDEX	71



Halibut are stacked like cordwood in this Juneau, Alaska, cold-storage plant. (BCF-Alaska photo: J. M. Olson)

U.S. FISHERMEN EARNED RECORD $518 MILLION IN 1969

U.S. fishermen caught 4,292 million pounds of fish and shellfish in 1969. The catch sold for $518 million--the highest dollar value ever. The value was $47 million above 1968, and 31% above previous 10-year average. The catch was 176.4 million pounds, or about 4%, more than in 1968, and the largest catch since 1966. These data were reported by BCF's Division of Statistics and Market News.

There were record landings of Gulf menhaden, Pacific anchovies, yellowfin tuna, shrimp, spiny lobsters, tanner crabs, Dungeness crabs, and surf clam meats in 1969; and sharp increases in the catches of Atlantic cod, Pacific halibut, and blue crabs. Landings of Atlantic flounders, pollock, and soft clams were higher than in 1968.

Offsetting any real large gain in overall productivity of domestic fisheries were serious declines in landings of haddock, Atlantic sea herring, Pacific salmon, whiting, otter-trawl-caught industrial fish, sea scallop meats, and king crab. Production of jack mackerel, Atlantic ocean perch, and oyster meats also was below 1968 levels.

Record 12.08¢ A Lb.

Fishermen were paid a record average of 12.08 cents per pound for the larger 1969 catch; in 1968, the average was 11.46 cents; in 1967, 10.84 cents. The average price for many fishery items increased substantially in 1969, while other prices were somewhat higher, or at least held steady.

The smaller 1969 whiting catch (down 41%) actually gave fishermen as much money as the larger 1968 catch. Average prices paid for most other failing fisheries also increased to where total exvessel value paid was nearly equal to that received for the larger 1968 catches. Average prices paid to fishermen, measured by indexes of exvessel prices received, rose 13% from 1968 and 40% above 1957-59 average.

The index for all finfish prices rose 14% in 1969 because of sharp increases in prices for New England finfish, salmon, tuna, and industrial fish. Prices paid for all shellfish increased 14%. Prices for shrimp increased 9%, while other shellfish prices increased 17%.

PROCESSED FISHERY PRODUCTS

The 1969 value of processed fishery products produced in the U.S. from domestic and imported raw material was $1.5 billion--about 6% above 1968. The canned pack of 40.3

million standard cases was worth $580.8 million--slightly below 1968's record $583.9 million.

Canned tuna was produced at about 1968 level; packs of crab meat, shrimp, and clam products were larger.

Industrial products increased $14.5 million.

The remarkable fish stick and portion industry continued to set new volume and value records: Production was 329.8 million pounds valued at $134.7 million.

Breaded shrimp processors turned out 104.6 million pounds (just short of breaking 1966's record 104.9 million pounds). It was worth a record $110.5 million.

Domestic production of groundfish fillets and steaks continued to decline as expected, but output of other fillets and steaks increased. Total production of these items increased in volume and value in 1969.

Processors of fish and shellfish specialty dinners, and other packaged fish and shellfish products, continued production increases. Their products were worth over $438 million--8% above 1968.

Exports of U.S.-produced fishery products were worth a record $104.5 million--a gain of $36.8 million--while imports also reached a new high of $844.3 million

AT YEAR'S END

At the end of 1969, some segments of the industry were facing declines in resource availability due to natural causes and heavy fishing; other segments remained highly competitive with foreign fleets and production. With only few exceptions, prices for fishery products generally increased at all levels: exvessel, wholesale, and retail. Fishermen received a high dollar exvessel value in 1969. The processing industry generally made excellent production gains. Many canned items, fish sticks and portions, fillets and steaks, shellfish (lobsters, crab, shrimp) products, and other fish and shellfish products were in good demand throughout 1969; many of these items made new inroads into foreign markets.

Civilian per-capita consumption of edible fishery products increased from 11 pounds of edible meat in 1968 to 11.1 pounds in 1969--the highest since 1954.

U.S. REGAINS 5TH PLACE IN WORLD FISHING

U.S. commercial fishermen caught about 5.5 billion pounds (live weight) in 1969, an increase of about 1 million pounds over 1968. This catch regained for the U.S. fifth place among the world's fishing nations. The catch figure includes the shell weight of mollusks, as is done by foreign nations. Shell weight is excluded in U.S. data on catch value.

Preliminary statistics indicate that Norway, formerly No. 5, dropped to sixth, the U.S. position in 1968. Norway's 1969 catch of 4.9 billion pounds was down 800 million pounds from 1968.

Japan Regains No. 1

Japan has regained the number one position she had held for many years. Her 1969 catch of 20.3 billion pounds was 1.2 billion greater than the 1968 figure.

Peru Falls to No. 2

Peru, which had led the world for several years, dropped to second place. Her catch was estimated at 19.5 billion pounds, a decline of more than $2\frac{1}{2}$ billion pounds. Peru's fishery is primarily anchovies. These are converted into fishmeal, and most of it exported.

USSR No. 3

Preliminary data show the USSR No. 3 with 16.1 billion pounds, up 1.4 billion from 14.7 in 1968.

Mainland China is believed to rank fourth. However, reliable statistics have not been available since 1960.

BCF IN COOPERATIVE SURVEY FOR INDUSTRIAL FISH IN ATLANTIC

BCF is using advanced electronic equipment and fishing gear in a cooperative Government-industry survey of herring and herringlike fish underway along the Atlantic Coast. The 3-month study began March 15 and will extend from New Jersey to Florida.

The midwater schooling fish are not used much by U. S. fishermen. These fish might supplement the declining Atlantic Coast menhaden, the most important "industrial" fish, which is used primarily for fishmeal.

Fishmeal Demand 800,000 Tons

The annual U. S. demand for fishmeal fluctuates around 800,000 tons: 200,000 tons are supplied by U. S. fishery, the remainder by imports. Annual imports are worth about $108 million. Use of the many species of herringlike fish by U. S. processors could significantly strengthen the fishing industry.

4 Survey Vessels

Four vessels will be used in the survey: the new stern trawler 'Delaware II' from BCF's North Atlantic Region, the 'Oregon II' from BCF's Gulf and South Atlantic Region, North Carolina's 'Dan Moore', and a menhaden industry vessel.

Commercial Scale Fishing

The Oregon II, equipped with sophisticated acoustical devices, will locate fish schools. The Delaware II, with modern acoustical fish-detection gear, will conduct commercial-scale fishing with pelagic (mid-water) and bottom-trawl fishing gear.

Catches will be transferred from Delaware II to the industry vessel and taken to shore. There, their suitability for fishmeal and oil will be evaluated.

Preliminary reports of findings are scheduled to be distributed by June 30.

SKIPJACK & YELLOWFIN TUNA SCHOOLS FOUND NEAR AMERICAN SAMOA

Scientists of the BCF Biological Laboratory in Honolulu have located numerous schools of skipjack tuna in the waters surrounding American Samoa, reports Richard S. Shomura, Acting Area Director, BCF, Hawaii.

In addition to skipjack, some mixed schools of skipjack and yellowfin were found.

American Samoa lies below the Equator, about 2,500 miles south and a little west of Hawaii. The Laboratory's research vessel 'Charles H. Gilbert' completed the first systematic survey of the area's fishery resources and returned to Honolulu in mid-April.

American Samoa is the site of two canneries. These depend for their raw materials not on surface-swimming fish caught near the islands--but on deep-swimming tunas from a broad belt of the open sea reaching almost to the South American coast.

The Government of American Samoa seeks to broaden the islands' economic base by harvesting surface-swimming tunas and other fisheries in the surrounding area.

Gilbert's Findings

The Gilbert's findings substantiate previous fragmentary reports that there are many schools of surface-swimming tunas in the area during the Southern Hemisphere summer. Sightings of fish schools approached five a day, about the average attained during the height of the Hawaiian summer season. The fishery for the skipjack tuna, the largest in Hawaii, reaches its peak in July.

Most of the skipjack caught were 10 to 14 pounds, smaller than the "season" fish in Hawaii. Fish were taken for tagging so scientists may follow their migrations. More than 500 fish have been tagged to date. These include yellowfin tuna, bigeye tuna, and skipjack. Blood samples were also taken. The samples will be analyzed later at the Laboratory in an attempt to trace the relation of the tunas of Samoa with those of other Pacific Ocean areas.

The Gilbert sighted skipjack tuna schools as far as 200 miles south of the Samoa Islands. To the north and northwest, beyond the independent nation of Western Samoa, the limits were much closer to shore; most sightings were within 40 or 50 miles of land.

The Gilbert carried a supply of live bait--threadfin shad--from Hawaii. She also was able to locate local bait supplies in Pago Pago Harbor.

SQUID SLURP IS TESTED SUCCESSFULLY

The Squid Slurp, a new pumping system, promises to eliminate much of the hard work in the San Pedro, Calif., squid fishery, reports Dr. Alan R. Longhurst, BCF La Jolla Laboratory director. The system was developed by Matt May and Bob Payne, operators of the 68-foot commercial fishing vessel, ERM-TOO, and Susumu Kato, fishery biologist at La Jolla.

During one day's fishing in February, May and Payne landed 30 tons of squid (now selling for $27.50 a ton dockside) at Port Hueneme. This was not unusual for them because they have been fishing squid for many years. But these squid were caught with a pump--without any net or brail. It was a cooperative experiment in which BCF provided most of the gear, while May and Payne contributed their vessel and fishing experience.

Traditional Squid Fishing

The traditional way to fish squid, explained Dr. Longhurst, is to anchor the vessel and turn on attracting lights at dusk. Brailing begins when enough squid gather under the lights. Usually, one fisherman holds on to the handle and purse line of the brail, while second pulls the brail through the concentration of squid. A third man operates a winch, which lifts the brail out of the water, and dumps the squid into the ship's hold.

With the Squid Slurp, the lighting arrangement remains unchanged, but the basic fishing unit is a pump with an 8-inch-diameter inlet that sucks in water at the rate of 1,600 gallons per minute to the pump inlet. A flanged elbow and 10-foot section of steel tubing is attached to a funnel with an opening measuring 3 feet by $1\frac{1}{2}$ feet. Inside this funnel is placed a waterproofed light, and the entire unit is submerged. An 8-inch fish hose carries the squid to a dewatering screen on board, which leads to either of two fish holds by means of an adjustable chute.

On the night of February 25, squid rose abundantly under the lights. The pump on the ERM-TOO was started at 8 p.m. The squid were pumped slowly and steadily into the well but, during one 15-minute period when they swam directly toward the funnel, about 10 tons were taken aboard. After 4 to 5 hours of pumping, 61,350 pounds of squid were taken aboard.

Pump's Advantages

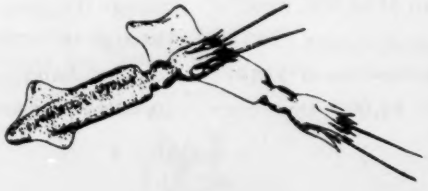
Dr. Longhurst noted that the pump will reduce the crew to two and eliminate brailing. When squid are running directly into the funnel, pumping is faster than brailing. Only one man is required to stay on deck to watch over the pumping operation and to chase away the birds, sharks, pilot whales, and sea lions that prey on the squid and cause them to dive. Meanwhile, the second man can sleep and be ready for the long run to the processing plant.

Chief Disadvantage

The chief disadvantage of the pump, at least with the present setup, is that operations are difficult in rough seas. Pumping is also slower than brailing when squid are "dead" under the lights, or when they swim away from the entrance to the funnel.

Encouraged by their early success, May and Payne later decided to enlarge the funnel entrance to 6 X 4 feet. With this modification, they have landed up to 160,600 pounds (80.3 tons) of squid with the pump in one night's fishing. This is a record for a two-man crew.

Dr. Longhurst concluded: "With further improvements in the equipment and perhaps in the lighting system, pumping may eventually outfish brailing under all condtions."



SAN PEDRO FLEET'S FINANCIAL CONDITION STUDIED

BCF's Pacific Southwest Region reports that, in 1968, researchers at the BCF Fishery-Oceanography Center, La Jolla, Calif., began to investigate the financial condition of the San Pedro "wetfish" boat fleet. The fleet is composed of small (40 to 86 feet) purse seiners that operate within 100 miles of port. Its boat owners and fishermen have been financially hard-pressed for years. They complain of static prices for fish and rising costs. Between 1958 and 1968, the fleet dwindled from 48 to 25 vessels. Its newest vessel was built in 1947; half of the fleet was built before World War II.

1967 Landings

In 1967, the fleet landed about 82 million pounds. It accounted for 77% of jack mackerel, 54% of Pacific mackerel, 58% of bonito, 12% of bluefin tuna, and 54% of anchovies landed in California. Mackerel, bonito, and tuna are canned; anchovies become fish meal and oil.

Poor Financial Shape

The researchers' first objective was to describe and document the fleet's financial condition. With vessel owners' permission, financial data were gathered from bookkeeping firms. Analysis showed the fleet in poor financial shape. During 1963-68, annual revenue ranged from $45,000 to $120,000, profits from $1,400 to $34,000, and losses $200 to $10,000. The average gross revenue of $70,000 produced a profit of about $4,000; this corresponded to break-even point. Crew earnings stayed constant and averaged $4,000; crew size decreased from 380 to 240; number of vessels from 48 to 25.

Costs-and-Earnings Model

The second objective was to construct a costs-and-earnings model for wetfish operations. This would permit examination of the economic feasibility of new-vessel construction for vessel replacement or fleet expansion. The model took account of operating costs, taxes, depreciation, and arbitrary levels of gross revenue corresponding to those in the fishery in recent years. Their profit return on investment and crew earnings were predicted for vessels of various sizes--newly constructed or existing--for various conditions of catch.

Other Fisheries' Surplus Vessels

The researchers concluded that, with proper market conditions, fleet expansion through recruitment of suitable surplus vessels from other fisheries would be economically feasible. The outlook for new-vessel construction was found unfavorable. Even with a 50% construction subsidy, a vessel would need $225,000 gross revenue, an amount well above present peak levels, to attain the 1967 profit level. However, the picture would change if vessel efficiency could be increased through technological improvements in fishing and handling procedures. BCF and the industry are examining these possibilities.

GATE DESIGNED TO RELEASE PORPOISE FROM PURSE SEINES

After talking to fisnermen, gear technologists, and behaviorists, William Perrin of BCF LaJolla, Calif., developed a tentative design for a rescue gate for porpoise caught in purse seines. A triangular piece of webbing will be cut from the net to leave a gap about 4 fathoms long and 1 fathom deep at the center. Then, a large triangle of webbing will be sewn into the opening. The corkline for this section will consist of several inflatable sections, perhaps constructed of large diameter firehose. A system of independent air conduits will lead to a single connector at the end of the gate area. A skiff equipped with a gasoline-powered vacuum pump and compressed air tanks will connect to the air system after the net is set; the skiff will remain stationed at or near the gate during the rescue operation, which will be coordinated from the mast.

Opening and Raising Gate

The gate will be opened by evacuation of the corkline--and raised by rapid injection of air from the tanks. A prime requisite is that it be possible to raise the gate in a second or two when fish are seen heading toward it. It is hoped the extra webbing will reduce downward pull of the sunken corkline.

Modeling experiments using a miniature purse seine are being carried out. Construction of a prototype will begin immediately thereafter. If all goes well, the gate should be ready for testing under actual fishing conditions in late summer 1970.

●oo●oo●

FISHERIES FEATURED AT MARINE TECHNOLOGY SOC. EXPO.

On Monday, June 29, 1970, the Marine Technology Society Conference and Technical Session will open at the Sheraton Park Hotel in Washington, D. C., and run through July 1. The Nation's suppliers of oceanographic equipment will meet "to discuss past, present, and future problems and hopes of the ocean environment."

One entire afternoon session will be devoted to Marine Biological Resources--fish, oysters, and lobsters. It will include three papers by BCF speakers: "Recent Developments in the Economic Theory of Commercial Fishery Management," E.W. Carlson and A.A. Sokoloski; "The Determinants of Actual and Subsidized Competitive Strengths and Weaknesses of the U.S. and Canadian Groundfish Fisheries," Donald P. Cleary and A.A. Sokoloski; "Economic Benefits to Fisherman, Vessels and Society from Limited Entry to the U.S. Northern Lobster Fishery," F.W. Bell. Also, "Computerized Modeling of an Acoustic Fish Abundance Estimation System," John B. Suomala Jr. and William Vachon, MIT; "Optimal Conditions for Oysters Grown in Closed Environments," George Claus and Cyrus Adler, Offshore/Sea Development Corp.

At another session, BCF's Edward F. Klima will talk about the development of an advanced-technology high-seas fishery and processing system.

Several other sessions among the 26 should interest CFR readers: buoys, undersea vehicles, marine geodesy, seagoing computers, cables and connectors, power systems for undersea habitats, oceanographic instrumentation, underwater optics, waste management and coastal zone, ocean mining, economic considerations in coastal zone management, critical legal issues, risks and opportunities in ocean industry, and corrosion of equipment at sea.

General Chairman of the MTS Conference is Donald L. McKernan, Special Ambassador for Fisheries and Wildlife to the Secretary of State, president-elect of MTS, and former head of BCF.

For more information, contact MTS, 1730 M Street NW., Washington, D.C. 20036

●oo●oo●

INTERNATIONAL FISHERIES SURVEY CONTINUES OFF U.S. WEST COAST

The Soviet research vessel 'Ogon' left San Pedro, Calif., on March 13 to continue an international fisheries survey of the population of Pacific hake off Oregon and Washington. The vessel is operated by the Far Eastern Seas Fisheries Research Institute in Vladivostok.

Dr. Alan R. Longhurst, director of the BCF laboratory at La Jolla, reported that Ogon had just completed an egg-and-larva survey of spawning hake off California and Mexico with the assistance and advice of U.S. fishery biologists.

The Pacific hake spawns off California and Mexico each winter. The abundance of adult hake is estimated from the number of their eggs and larvae taken in plankton samples.

2nd Year of Cooperation

This is the second year of cooperative research on U.S. hake fisheries. The hake is a favorite food of Soviet citizens. It is fished heavily by the Soviet fleet in international waters off the Pacific Coast; in the U.S., hake is an important raw material in producing fish protein concentrate (FPC). The data from the cooperative surveys are necessary to provide a scientific basis for agreements to protect and conserve the species off North America.

San Francisco to Vancouver Island

Ogon is under the scientific leadership of Dr. Nikolai S. Fadeev of Vladivostok. The Soviet vessel rendezvoused on March 18 with a U.S. Coast Guard cutter to take aboard an observer, Eugene S. Maltzeff of BCF's Seattle laboratory. With him aboard, Ogon began using her acoustic echo-sounders to survey hake and rockfish stocks from San Francisco to Vancouver Island. The survey will end at the island by the end of May. The vessel will fish only to check the results of the acoustic survey.

Already, BCF scientists at La Jolla are working on samples and data from Ogon's plankton survey. They have found that hake, in response to warm ocean conditions, have spawned this year considerably farther north than last year.

As in previous years, the data from the acoustic surveys will be received from the Soviets at a scientific meeting in Moscow this fall.

Mary Kalin, BCF biological technician, sorts plankton samples for presence of hake eggs and larvae aboard Soviet research vessel Ogon--in presence of Dr. Nikolai S. Fadeev, vessel's chief scientist.

U.S. VISITORS WELCOMED ABOARD SOVIET FISHERY VESSEL

A 9-man U.S. team visited a Soviet factory ship on March 6, about 15 miles off Norfolk, Va., during the vessel's 6-hour stay. The team was permitted full freedom of the vessel.

A similar visit took place in April 1969. Both were made under a 1968 U.S.-USSR agreement on fisheries of the U.S. Middle Atlantic Coast. The two-year agreement, which extends and modifies one in effect since November 1967, provides that both nations will work together in developing information to conserve certain species: red hake, silver hake, scup, and fluke. These concentrate offshore in large schools during winter before moving inshore, where they are caught by U.S. fishermen.

The Soviet Union has agreed not to fish between Jan. 1 and March 30 in a 3,000-square-mile protected zone extending from Rhode Island to Virginia. This area is believed to be the prime spawning grounds of these species.

'Chopin' & the Fleet

The Soviet fleet fishing in the Atlantic from Rhode Island to Virginia is commanded by Viktor Zakharov, Western Fisheries Administration, with headquarters in Riga. His flagship is the 'Frederik Chopin,' a 5-year-old, 543-foot vessel built in Poland's Gdansk shipyards. The U.S. visitors described her as "clean and well kept with up-to-date fish processing equipment."

Zakharov commands a fleet of about 100 fishing vessels, including 5 or 6 additional factory ships and refrigerated transports. Most of the fleet comes from the Estonian, Latvian, and Lithuanian Republics.

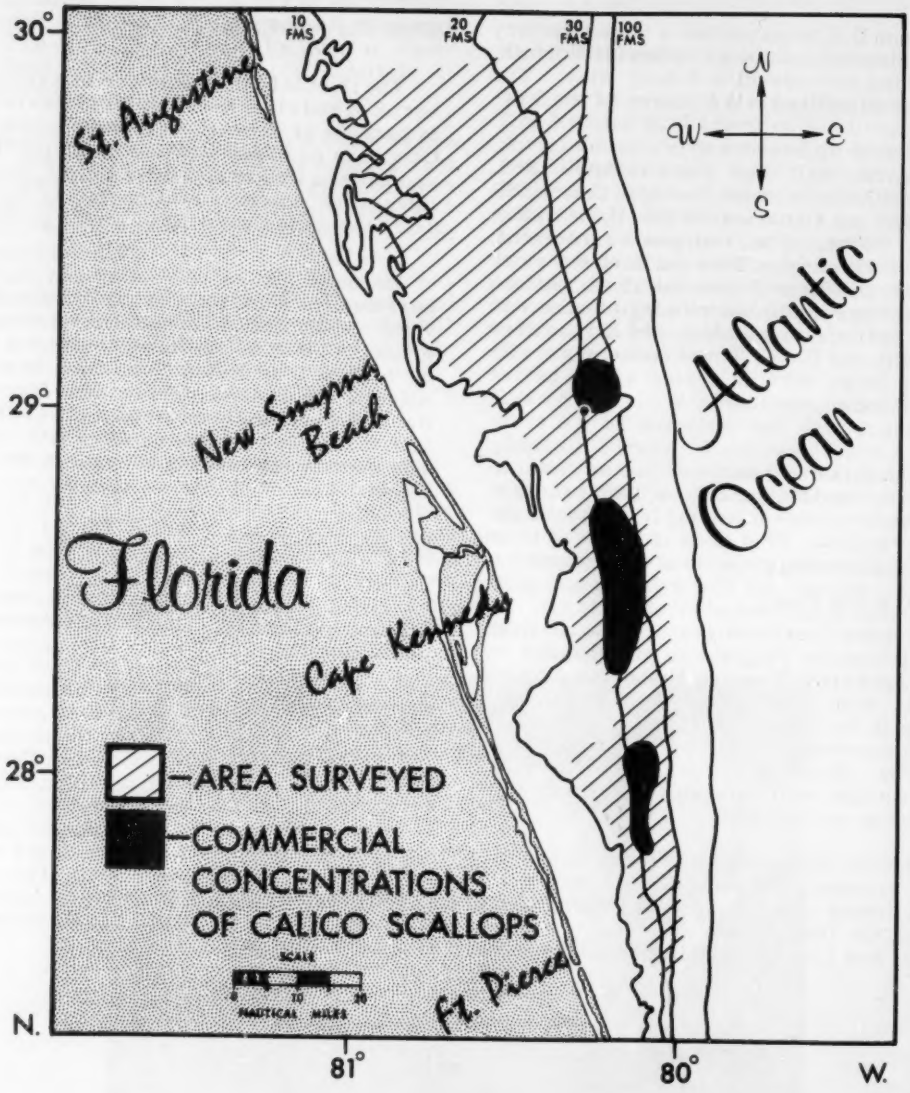
What They're Fishing

The fleet is fishing only for mackerel, sea herring, and river herring. Most fish is salted in barrels or frozen in freezing trays. The Chopin is equipped to produce canned fishery products as well as fish meal and oil, but these lines were not in operation during the visit. The vessel has a capacity of 13,600 gross tons.

Because stocks of Norway and North Sea herring are dwindling, Zakharov said, the Soviets had become interested in herring fisheries off the U.S. coast, which are not fished by Americans. He said herring from mid-Atlantic is less desirable than Norway or North Sea herring because of a lower fat content, but larger catches compensate for this. The demand for herring is good in the Soviet Union.

No Menhaden

The U.S. team also reported the Soviet claim that they have caught no menhaden. The Soviets believe this species stays close to the U.S. shore, where the 12-mile limit prevents foreign fishing. The Soviet Commander explained that his vessel conducts no specialized fishery for scup or fluke. He doubted his fishermen would be interested in these species because the Soviet Western Fisheries Administration does not rate them commercially exploitable. He said the Soviets help enforce the mid-Atlantic agreement with the U.S. by refusing to pay for scup. This did not insure that in bottom trawling by large stern factory trawlers for other fish, there would be some incidental scup.


30°
29°
28°
N.
81°
80°
W.
10 FMS
20 FMS
30 FMS
100 FMS
N
W
E
S
St. Augustine
New Smyrna Beach
Florida
Cape Kennedy
Ft. Pierce
Atlantic Ocean
—AREA SURVEYED
—COMMERCIAL CONCENTRATIONS OF CALICO SCALLOPS
SCALE
0 10 20
NAUTICAL MILES

BCF MIAMI SCIENTISTS STUDY FLORIDA CALICO SCALLOPS

Ann Weeks

Scientists of BCF's Tropical Atlantic Biological Laboratory (TABL), Miami, Fla., conducted their tenth cruise to calico scallop grounds off Cape Kennedy from March 28 to April 3 aboard the 83-foot research vessel 'Bowers' of BCF Pascagoula, Miss.

The 5-man team was directed by Thomas J. Costello, chief of the calico scallop program; it consisted of 3 biologists and 2 technicians, much of whose research was done underwater.

What They Did

They positioned a second diving buoy near one that has been in place 6 months as a marker for an ocean-floor research station. They installed new sensing devices on the bottom, obtained scallops for age-growth and tissue study at TABL, marked and released more scallops for later study, and installed special devices on the bottom and in the water column to collect infant scallops.

Stepped-Up BCF Program

Dr. Carl J. Sindermann, TABL director, said the intensive investigation of calico scallop stocks is part of a heightened BCF effort to help U.S. commercial fishermen land satisfactory catches of profitable seafood species.

He added: "Ordinarily we in the field of marine biology do not indulge in superlatives, but the calico scallop beds--which cover 1,200 square miles just off the north Florida coast--seem nothing short of fabulous." Estimates by BCF and the fishing industry, barring catastrophes, predict an eventual annual catch, perhaps as early as 1975, of 15-20 million pounds. The figure breaks down to an expected annual catch of about a half-million pounds by each of 30 vessels.

Sindermann said: "In view of the wholesale price of about $1.35 per pound paid for calico scallops last year, it's easy to see that this exciting new fishery could be immensely valuable to our fishermen."

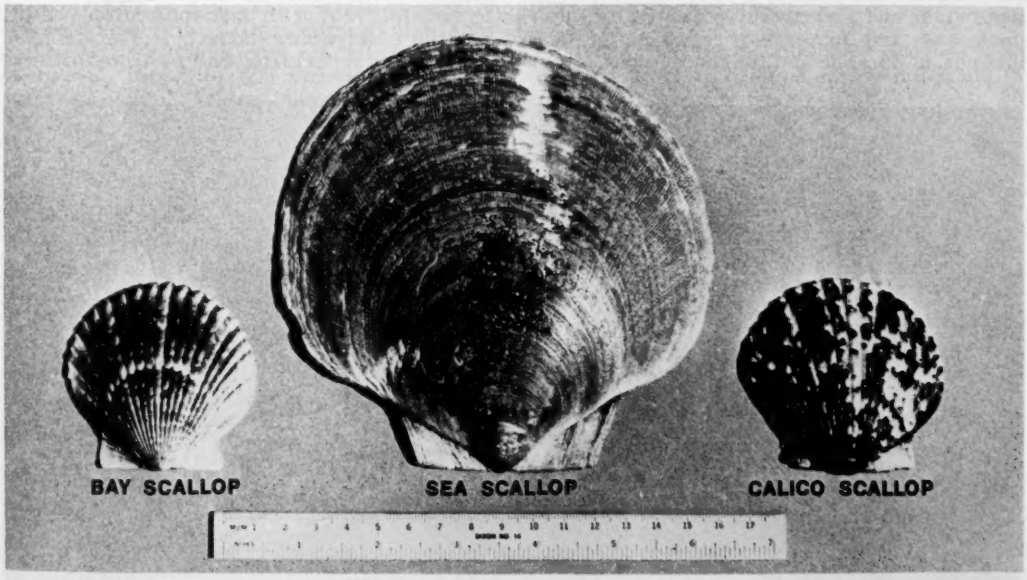


Fig. 1 - Gourmets prize the small, delicately flavored, and expensive bay scallop; most homes and restaurants buy and serve the larger sea scallop; those who have sampled the calico scallop claim that its flavor and delicacy match those of the bay scallop. The calico's edible meat is considerably larger than that of the bay scallop. Scallop fishermen are presently catching more calicos in one day than bay scallops in one year.

Field party chief Costello said that Florida landings of calico scallops in 1969 amounted to 160,300 pounds of shucked meats. He warned, however, that the shellfish were not yet available for home consumption. "Most of the catch is now sold directly to restaurant corporations. Later--when the fishery emerges from its present experimental stage--supplies will probably be abundant enough for at least limited distribution to food markets."

Much Work at Bed Sites

TABL marine scientists seek a better biological understanding of the life history of the bottom-dwelling mollusc. As a new fishery develops, it becomes increasingly important to know everything possible about growth and reproduction cycles, stock sizes, longevity, diseases to which the animal may fall prey, effects of fishing on the stocks, and the marine environment in which a species lives. Much of the scientific work involving calico scallops is done at the site of the beds. Specimens are marked, returned to their habitat, and retrieved later to ascertain just how far they may move in a given period; "spat" (infant stages) are planted in certain locations so survival and growth rates can be defined; specimens are examined periodically for evidence of damage by disease or predators; population rates are closely and frequently monitored; and oceanographic conditions are studied and charted.

Controlled Lab Experiments

In controlled experiments at TABL, thousands of calico-scallop eggs have been reared from moment of fertilization through several larval stages. These successful rearings are important to fishery biologists, who rely on written descriptions of the physical characteristics of myriad numbers of marine organisms, many of which change drastically as they pass from larval into adult stages. Because larval calico scallops have never before been described in the scientific literature, a marine biologist who found such larvae in a sample of seawater would be unable to do more than guess its identity.

Gear & Vessel Research

Gear and vessel research related to the calico scallop is carried out by other BCF laboratories, primarily the Exploratory Fishing and Gear Research Base at Pascagoula, Miss. One scallop-locating device that has yielded excellent results is the RUFAS (remote underwater fisheries assessment system), invented through joint efforts of BCF and the electronics industry. The RUFAS is a sled-like vehicle that can be towed over the

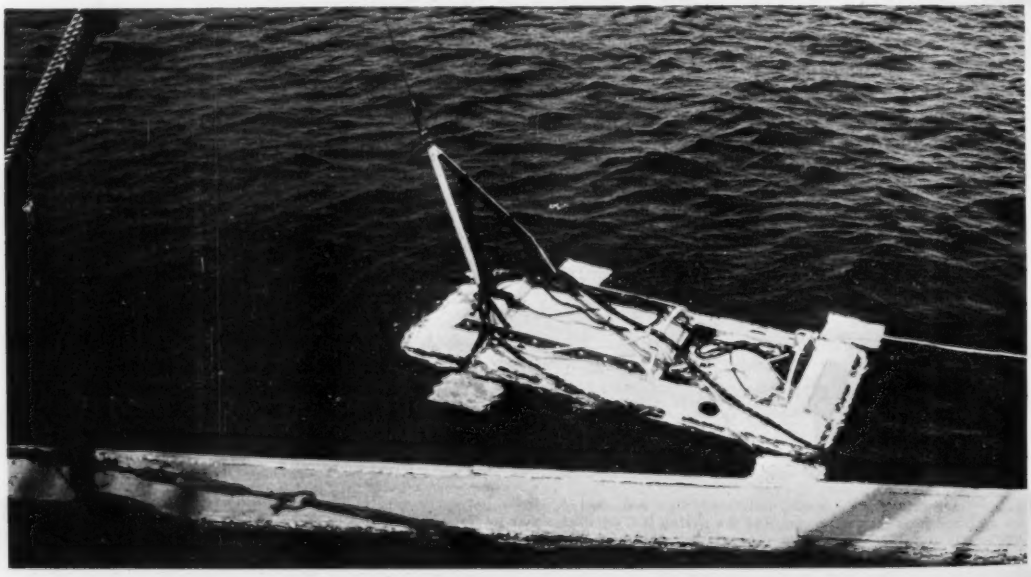


Fig. 2 - RUFAS (remote underwater fisheries assessment system). (Photo: J. B. Rivers.)

scallop beds by a surface vessel. Operated by remote control, the instrument contains a closed-circuit color television, video and audio tape recording equipment, and a high-quality movie camera.

In one recent survey, RUFAS took clear pictures of scallop beds covering 70 miles at 15 to 25 fathoms. The results pinpointed for fishermen the precise location of light, medium, and heavy concentrations of scallops. This reduced appreciably the time ordinarily spent trying to locate productive grounds.

Last year, BCF hired a Perry "Cubmobile" (a 3-passenger, deep-diving submarine) for close study of the seabed off Cape Kennedy. Several skippers of scallop vessels accompanied BCF scientists in exploratory tours of the ocean bottom.

Fishing the Scallops

In 1969, major catches of calico scallops off north Florida were made from 4 vessels designed specifically for scallop fishing and processing. Two were factory vessels capable of dredging catch, then culling, shucking, eviscerating, freezing, and packaging the scallops while at sea. The vessels generally stay out 5 to 8 days (steaming to and from scallop grounds takes only a few hours), and process as much as 200 pounds of scallop meats per hour. Fishing is continuous, night and day, with a 14-man crew working 12-hour shifts. As processing methods improve, a 1-week trip is expected to yield about 15,000 pounds of calico scallop meats. The specially equipped vessels have been so successful that their manufacturers are thinking of producing 15 more ships for the highly promising calico scallop fishery off northern Florida.

Mrs. Weeks is TABL Writer-Editor.

SHRIMP-SORTING TRAWL IN GULF OF MEXICO SO FAR INEFFECTIVE

Tests aboard the 'George M. Bowers' recently revealed that the west-coast-type shrimp-separator trawls of current design were not effective in the Gulf of Mexico. Because the fish associated with shrimp in the Gulf are small, separator trawls using vertical panels have been ineffective in sorting fish from shrimp as small fish pass through separator panel in significant amounts. Sixty-five percent of shrimp went into side bags, and 80-90% of trash fish went into fish bag or trash chute.

LONGLINER IN GULF OF MEXICO LANDS 22,000 LBS. OF SWORDFISH

The east coast longliner, 'Gulf Stream', landed 22,000 pounds of swordfish at Pascagoula, Mississippi. It was her second trip.

The catch was made during 11 days, including travel to and from grounds; 10 longline sets were made.

The first trip's landings were 18,600 pounds during 9 days; 8 sets were made.

BCF Aid Asked

As a result of Gulf Stream's landings, BCF's Exploratory Fishing and Gear Research Base in Pascagoula, Mississippi, is receiving many requests for information and assistance.

'DELAWARE II' FINDS OCEAN QUAHOGS OFF SOUTHERN NEW ENGLAND

Extensive, commercially usable, concentrations of ocean quahogs (Arctica islandica) were located by BCF's Delaware II in January and February off southern New England (Cruise 70-1). More surveys are planned.

During the cruise between Nantucket Shoals and Amagansett, Long Island, New York, 382 survey stations were fished. This includes the eastern section of ocean quahog survey area 7 and western section of ocean quahog survey area 8 (see chart). The dredge was fished routinely for 4 minutes during each tow; one tow was made at each station.

Fig. 1 - Ocean quahogs. Size varies from 3 to 4 inches in length, 2.5 to 3.5 inches in height, and 1 to 1.5 inches in width. The colors range from dark mahogany to mottled black and white.

In area 7, 139 tows were made in 10 to 35 fathoms. Catches varied from a few individual ocean quahogs and surf clams to 5.2 bushels of ocean quahogs.

Of the 243 tows in area 8, in 20 to 35 fathoms, catches varied from 0 to 11.5 bushels of ocean quahogs. No live surf clams were found, although shells were taken.

Gear Development

The Delaware II has a high freeboard, so conventional dredge handling methods (hoisting dredge from vessel's side with a boom) were not practical. A new dredge handling system had to be designed.

A recent survey of the New Jersey clamming industry uncovered a method of setting and hauling the dredge from a vessel's stern. It was concluded that this method might be adapted to the stern trawler Delaware II. The current installation is a modified stern-haul system devised originally by Captain Eric Kirkeberg of Wildwood, New Jersey.

Figure 2 is a profile of the deck equipment. It identifies the major components. To set the dredge, the trawl warp is payed out--permitting dredge to slide down ramp and off vessel's stern. To haul dredge back, the docking ramp is first opened by hydraulic rams, and the wire is captured in the deep "V". Then hauling is started. Just as the dredge breaks the surface, the docking ramp begins closing as the haulback continues. The dredge is hauled to a point on ramp where bottom trap door can be opened to dump catch on sorting table. After dumping catch, the trap door is closed, and the dredge immediately set again. Sorting is done at tabletop level as trash,

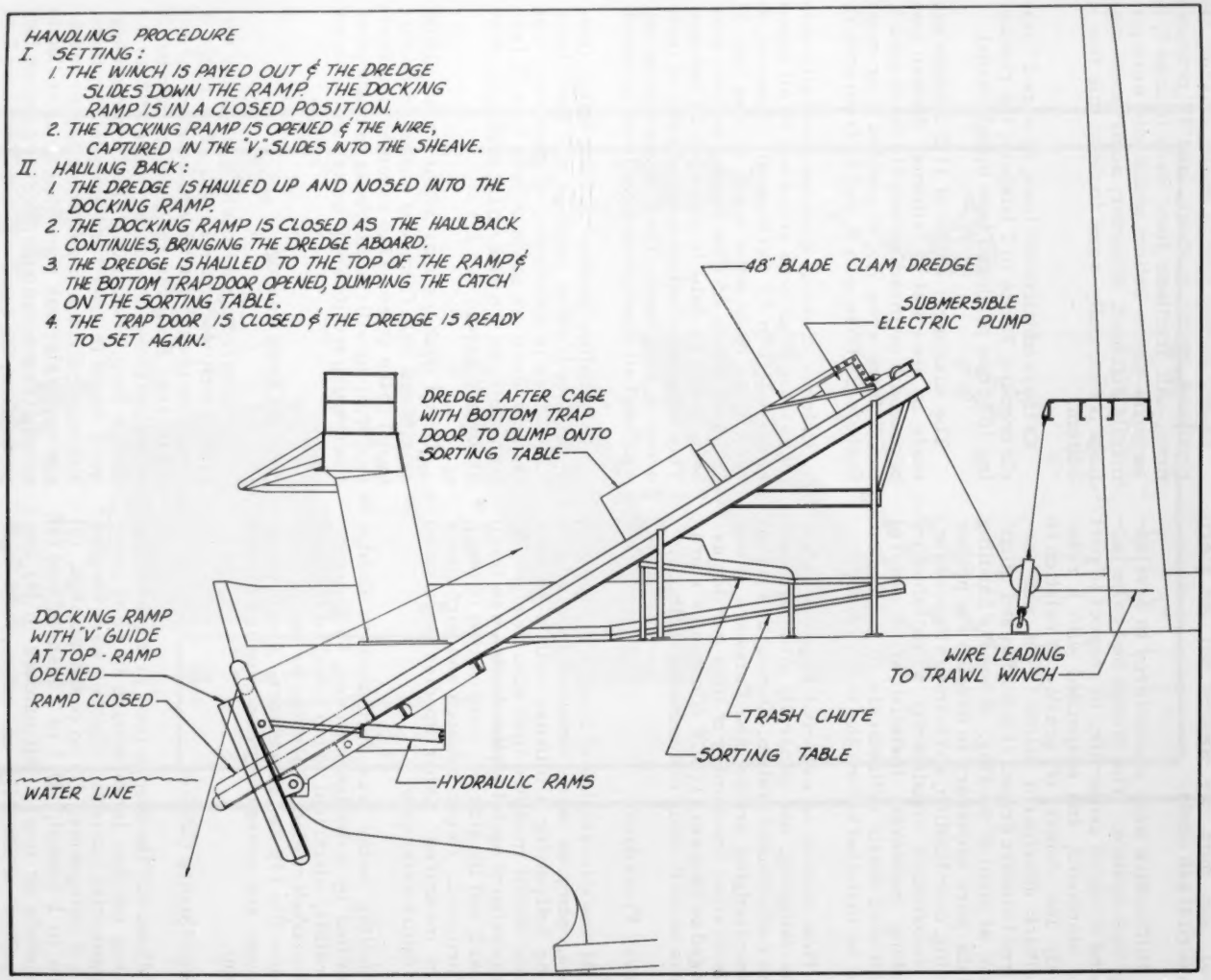

HANDLING PROCEDURE
I. SETTING:
1. THE WINCH IS PAYED OUT & THE DREDGE SLIDES DOWN THE RAMP. THE DOCKING RAMP IS IN A CLOSED POSITION.
2. THE DOCKING RAMP IS OPENED & THE WIRE, CAPTURED IN THE "V," SLIDES INTO THE SHEAVE.
II. HAULING BACK:
1. THE DREDGE IS HAULED UP AND NOSED INTO THE DOCKING RAMP.
2. THE DOCKING RAMP IS CLOSED AS THE HAULBACK CONTINUES, BRINGING THE DREDGE ABOARD.
3. THE DREDGE IS HAULED TO THE TOP OF THE RAMP & THE BOTTOM TRAPDOOR OPENED, DUMPING THE CATCH ON THE SORTING TABLE.
4. THE TRAP DOOR IS CLOSED & THE DREDGE IS READY TO SET AGAIN.
48" BLADE CLAM DREDGE
SUBMERSIBLE ELECTRIC PUMP
DREDGE AFTER CAGE WITH BOTTOM TRAP DOOR TO DUMP ONTO SORTING TABLE
DOCKING RAMP WITH "V" GUIDE AT TOP - RAMP OPENED
RAMP CLOSED
WATER LINE
HYDRAULIC RAMS
SORTING TABLE
TRASH CHUTE
WIRE LEADING TO TRAWL WINCH

Fig. 2 - Stern chute clam dredge ramp used aboard Delaware II.

sand, and mud are washed out the stern through trash chute.

Difficulties were encountered in developing this system. The dredge had to be balanced along its centerline, in respect to port and starboard, and suspended with a relatively low center of gravity in relation to haulback attachment points. This was required to insure proper orientation and alignment at point of docking. A week's handling trials were necessary to develop the proper timing, coordination, and teamwork necessary to accomplish consistently a satisfactory docking maneuver. Installation of several additional small refinements to the system will be installed before the next cruise.

This system is expected to prove safer, less fatiguing, and generally more efficient than conventional system. During this initial clam-dredging cruise, the Delaware II was able to equal the number of tows per day averaged by Delaware I (BCF Gloucester's previous vessel) using conventional methods.

Survey Procedure

At the intersection of 2-mile spaced grid lines, samples were obtained by dredging along bottom for 4 minutes with a 48-inch (knife width) modified hydraulic dredge. At completion of each tow, the dredge was taken aboard, and the size and composition of catch determined. Ocean quahogs and surf clams were measured. Other species were noted for future reference.

Jetting water was furnished to dredge manifold by a dredge-mounted, 65 hp., submersible, electrical pump powered through a 4-conductor electrical cable by one of Delaware II's 150 kw. generators. Ample water volume and pressure were supplied by this pump.

Ocean Quahog Catches

About half the dredge tows produced ocean quahog catches large enough to be of some commercial interest. Catches were divided into 4 categories: (1) no ocean quahogs. (2) none to 1 bushel, (3) 1 to 2 bushels, and (4) 2 bushels or more. All catches in (4) are classified arbitrarily as commercial-size catches. However, many catches in 1 to 2-bushel category were just under 2 bushels; these would also be commercially valuable.

Of 382 survey dredge stations fished, 340 produced ocean quahogs, and 42 produced none. All fruitless tows were in area 8, in sections where bottom sediments were primarily soft mud. However, some ocean quahogs occasionally were found in this type of bottom.

Of the productive 340 tows, 94 were 2 bushels or more, 79 one to 2 bushels; the remaining 167 tows produced less than 1 bushel.

The maximum catch of 11.5 bushels was made in area 8 at 30 fathoms. Sixteen tows produced 5 or more bushels (14 from area 8, and 2 from area 7); 48 yielded 3 or more bushels (38 from area 8, and 10 from area 7).

Catches of ocean quahogs generally were taken throughout both areas and in all depths surveyed (10 to 35 fathoms). However, in area 8, no tows were made in less than 20 fathoms; south of Cox Ledge, no tows have been made to date in less than 24 fathoms. This is because bottom in shoal water of these areas is very hard. Their investigation will wait until all other areas have been surveyed.

The shallow waters off Long Island (area 7) produced ocean quahogs and surf clams, but neither in abundance. Commercial-size catches were not made at less than 21 fathoms. Bottom sediments primarily were sandy and hard.

Ocean quahogs may occur in an almost continuous belt from one end of areas surveyed to the other. This assumes that future explorations will find that beds in unsurveyed intervening sections will be as numerous and dense.

Size of Ocean Quahogs

Samples from each ocean quahog and surf clam catch were measured. The range of length for ocean quahogs was between 1.3 and 4.4 inches. However, the greatest number of ocean quahogs measured were 2.8 to 3.8 inches long. Generally, the larger quahogs were found in area 7 off Long Island; there, although individual clams were larger, average catch size was somewhat smaller than in area 8. Few ocean quahogs over 4 inches long were taken; the same was true for those less than 2 inches long. The smallest size clams found probably do not reflect significantly either the occurrence or abundance of small

72°
71°
70°
41°
NANTUCKET
MARTHA'S VINEYARD
NANTUCKET SHOALS
BLOCK ISLAND
cox ledge
LONG ISLAND
AREA 7
AREA 8
CRUISE 70-1
UNSURVEYED
STATIONS PRODUCING TWO OR MORE BUSHELS OF OCEAN QUAHOGS PER TOW

clams because the dredge was not designed to retain the smaller quahogs. The scarcity of larger quahogs probably was due to fact that very few quahogs attain a size of over 4 inches during their life cycle in areas surveyed.

Many shells of the ocean quahog and other shellfish species were taken; abundance varied from station to station. In one section of area 8, bored shells were quite prevalent; these probably reflect a heavy infestation of predators.

The very few surf clams taken came from inshore depths of area 7. This is compatible with previously collected data from shallower waters of area 8. Other shellfish were taken from time to time, along with various finfish. It is of special interest that several specimens of the common razor clam were taken from some of the deepwater stations.

Samples of ocean quahogs were provided to interested industry members--and to BCF's Technological Laboratory at Gloucester, Mass.

For more information, contact Keith A. Smith, Base Director, or Phillip S. Parker, Fishery Biologist, EF&GR Base, State Fish Pier, Gloucester, Mass. 01930. Telephone: 617-283-6554.

CRABS ARE SERIOUS PREDATORS OF CLAMS

Studies by BCF's Milford (Conn.) laboratory of the predation rate of rock crabs and mud crabs on juvenile clams show these crabs to be serious clam predators.

A single rock crab can destroy as many as 25 10 mm-long clams per hour; a single mud crab up to 14 small clams (5 mm long) within one hour.

Rock & Mud Crabs Numerous

Rock crabs (Cancer irroratus) may be as numerous as 4 per square meter; mud crabs (Neopanope texana) up to 20 per square meter on shellfish beds.

"It seems probable, therefore, that these two species of crab could almost destroy a good commercial set of clams."

KING-SIZED CLAMS MAY BE MARKETED

The geoduck, a king-sized clam (2 to 3 pounds) of the Puget Sound area, is a prize catch of sport clam fishermen on low tides. Currently, reports BCF Seattle, the Washington Department of Fisheries is investigating the commercial feasibility of marketing geoducks for the first time from an untouched deep-water resource (30 to 40 feet).

Large Clam Population

Previous studies showed the State has about 9,000 acres of this subtidal land with an estimated clam population of over 40 million. The biologists say the average clam is 12 years old, so only a small part of this reserve should be opened for commercial exploitation. These clams are taken by SCUBA divers with a suction device. Small trials are being made for harvesting geoducks on a 500-acre area. However, it is estimated that several hundred thousand pounds can be harvested yearly on a sustained-yield basis.

COLUMBIA RIVER SMELT PROMOTED IN MIDWEST

Each February and March, the lower Columbia River produces large quantities of smelt, reports BCF Seattle. With improved harvesting techniques developed by BCF's Exploratory Fishing and Gear Research Base, an above-normal surplus is expected this year.

BCF marketing personnel discussed with Washington firms the possibility of expanding their markets for fresh and frozen Columbia River smelt.

Midwest Sales

Samples of dressed and round smelt were shipped to Minneapolis for distribution to retail chains by BCF marketing personnel. Some 72,500 pounds were sold to retail chains in Houston, Dallas, Milwaukee, and Minneapolis. BCF Seattle hopes this is just a start in proving that Columbia River smelt can be sold outside the traditional Washington-Oregon area.

10-YEAR PLAN TO DEVELOP WILLAMETTE R. SYSTEM UNDERWAY

A program to speed development of the Willamette River system's potential for increased production of salmon and steelhead is being promoted by Oregon's Fish Commission, Game Commission, and BCF. One goal is to develop a natural, self-sustaining spawning run of 55,000 coho adults by 1978.

To achieve this, the Fish Commission has begun a program to plant 1.2 million juvenile coho salmon into the system each year for 9 years. The planting of small coho in 27 streams supplying 9 principal tributaries of the Willamette was completed around April 1. These fish will return as mature adults in fall 1971.

"Wild" Population Expected

During the last 5 years, an average of 6,600 coho adults passed above Willamette Falls each year.

It is expected that development of a "wild" population that will use completely, for the first time, the potential of the Willamette watershed will result from: completion of the new Willamette Falls fishway in 1971, improved water quality in Portland Harbor, and the heavy yearly planting program.

Enhance Anadromous Fish Runs

The development area embraces most of the breadth of the Willamette Valley, from the uppermost reaches of the tributaries northward to Oregon City. The Oregon Fish Commission believes development of the Willamette and its tributaries will be a major step in increasing Oregon's anadromous fish runs.

SOLUTION SOUGHT TO SALMON "SHAKER" PROBLEM

The Oregon Fish Commission, the California Department of Fish and Game, and west coast troll fishermen are working together to solve the coho "shaker" problem. The name "shaker" has been given to small coho salmon often shaken off the hook. The agencies and fishermen are concerting their efforts this season to gather information on the losses of sublegal size and out-of-season coho in northern California and southern Oregon ocean-troll fisheries.

The large number of these illegal coho killed while trolling for legal salmon during May and June concerns fishery agencies and fishermen. Biologists estimate the "shaker" mortality rate in this area is about 50 percent. Based on the estimated incidental catch of sublegal coho, it could mean a loss of up to 250,000 or more coho a year.

More Information Needed

The need for more information is apparent. Jim Bolin, manager of West Coast Trollers Association, offered the trollers' services in collecting the needed information during the 1970 season. Selected trollers will keep detailed logbooks, noting number, size, area, and time salmon were caught.

At end of 1970 troll-salmon season, the logbook information will be summarized and evaluated by Oregon, California, and Washington fishery agencies. The results will be reviewed with troll fishermen before any regulatory changes are recommended. Solutions could consider changes in seasons, minimum size limits, types of gear used, or a combination of these.

No Action Before 1971

No regulatory action will become effective before the 1971 season. If this is found necessary, legislative action would be required in California. The Oregon Fish Commission has authority to adopt regulations.

NEW MESH RESTRICTION FOR STEELHEAD IS EFFECTIVE

The $7\frac{1}{4}$-inch stretch-mesh size restriction placed on gill nets during the Columbia River commercial winter season by Oregon and Washington fishery agencies has effectively reduced the incidental catch of steelhead. So said Edw. G. Huffschmidt, chairman of Oregon Fish Commission, on March 16. This statement is supported by reduced steelhead landings--and results of a special experiment conducted during the 14-day winter season that ended March 5. The steelhead run appears smaller than average, but the study showed the fish were present and could be caught in good numbers with a "steelhead net" of 6-inch mesh.

2 Nets Compared

The study compared the effectiveness of the mesh restriction. It used two identical diver nets--except that one was a legal $7\frac{1}{4}$-inch taut mesh, while the other was the 6-inch taut mesh. Diver nets are gill nets with trammels, which are drifted near the bottom during the winter season. Under Oregon Fish Commission supervision, the two nets were fished alternately over the same drift by equally experienced and proficient commercial fishermen. The test fisherman using the 6-inch mesh caught 36 steelhead in 8 drifts over a 40-hour test period; the fisherman using the legal gill net managed only 6 steelhead. Both nets caught 8 chinook, indicating the larger $7\frac{1}{4}$-inch mesh net was as effective as the smaller net for chinook.

At the same time, the smaller steelhead are escaping the more restrictive gear: just 1 of 36 steelhead caught in the 6-inch mesh net exceeded 30 inches. In the more restrictive $7\frac{1}{4}$-inch net, 2 of 6 steelhead caught exceeded 30 inches. In the recent season, 61% of the steelhead exceeded 30 inches.

Mesh Restriction Effective

Figures on the recent winter season gillnet landings also bear out the effectiveness of the mesh restriction. Only 3,600 steelhead were taken, while 13,300 chinook were landed. Over the last 10 years, the average winter-season catch during seasons, varying from 14 to 19 days, has been about 5,600 chinook and 8,000 steelhead.

REPORTS ON SHRIMP SEPARATOR TRAWL IN OREGON ARE GOOD

The Oregon shrimp fishery has reported encouraging results from use of shrimp-separator trawls. Commercial vessels using separator trawls continue to make almost pure catches of shrimp; those using standard shrimp trawls are plagued with a high concentration of smelt and other contaminants.

4 Such Trawls Ordered

As a result of the early success of vessels using sorter trawls, fishermen converted another standard net to a sorter trawl recently, and ordered 4 new sorter trawls from netting companies.

ADVANCES IN CATFISH HARVESTING

The BCF Kelso, Ark., Exploratory Fishing Station is testing a new version of a haul seine brailing bag. This has an automatic triggering device that allows the boom operator to empty it without assistance. If successful, this new device will eliminate time loss and manpower during loading.

Slightly modified live cars also are being constructed. These have openings at each end for testing feasibility of using two or more live cars in tandem--while attached to the seine during hauling.

An experimental catfish grader has been completed and will be field tested. The reaction of catfish to wire mesh boxes with various openings is being observed in a test flume. Also, the reaction of catfish in ponds to changes in climatic conditions is being studied.

HEAVY ALEWIFE DIE-OFFS POSSIBLE IN LAKE MICHIGAN THIS YEAR

Severe winter weather and the predominance of alewives at critical age levels could result in heavy die-offs in parts of Lake Michigan this year, said Assistant Secretary of the Interior Leslie L. Glasgow.

Because the alewife population is much below the 1967 level, when millions of dead fish washed ashore, especially near Chicago, a die-off of that magnitude is unlikely. The Illinois and Indiana shores are the areas most likely to be affected by localized 1970 die-offs.

Water Temperatures Important

The 1969 annual alewife survey by BCF's biological laboratory at Ann Arbor, Mich., showed a 60% increase over the 1968 population. A severe die-off would not be expected this year under normal conditions; however, the Lake Michigan area had below-normal winter temperatures. Research shows that alewives cannot tolerate excessively cold water, although they may not die immediately. If water temperatures warm rapidly this spring, the added stress of adjusting to it could trigger severe alewife mortalities.

A Small, Short-Lived Fish

The Great Lakes alewife is small. Adults average about $6\frac{1}{2}$ inches and weigh about 2 ounces. It is used principally for fishmeal and pet food locally. Although alewives are live food for larger fish, including Coho and Chinook salmon and lake trout, they compete with other fish for space and food.

Lake Michigan alewife stocks are now largely older fish; over half the adults are in their fourth and fifth years. Alewives are short-lived in the Great Lakes. Only about 30% of Great Lakes alewives can be expected to survive their fifth year.

It is believed that alewives migrated from their native habitat along the Atlantic coast into the Great Lakes via the St. Lawrence River and canals. They are in all 5 Great Lakes; they are the most abundant fish in Lakes Ontario, Huron, and Michigan.

Advance information on die-offs is important to vacationers and operators of resort areas, beaches, hotels, restaurants, and other businesses.

The annual survey will continue when the Ann Arbor laboratory's role is changed to give greater emphasis to recreational fishing and environment quality.

On The Death of Lakes

On March 3, 1970, Carl L. Klein, Assistant Secretary of the Interior for Water Quality and Research, addressed a meeting in Washington, D. C., on lake restoration.

This is what he said:

Lake pollution is perhaps the most crucial and most difficult of water pollution problems. This should come as no great surprise to anyone. Lakes generally do not benefit from the same cleansing action as a strong river current which might help flush away contaminants or dissolve them in a powerful flow of clean water.

Even without the contribution of man-made pollutants, lakes tend to develop eutrophication problems because of the nutrients that accumulate in them. But man can and must do much more to prevent the process from speeding up and causing the premature aging—and dying—of our freshwater lakes.

Like the living thing that it is, a lake is born, grows—even breathes—and slowly dies. The life cycle may last many thousands of years—or it could be a lot less. Much depends on the habitation that surrounds it. Man and his technology have become perhaps the gravest threat of all to the survival of lakes and of the other natural waterways which provide us with so many needs and enjoyment.

Death comes as a result of a lake slowly filling with silt and sediment. This is a natural process which manifests itself in reeds and water plant beginning to accumulate in shallow waters. The natural flow of streams through a lake may drain out the water, turning it into a swamp. The swamp plants then may give way to sturdier plants of a drier soil, and eventually, the one-time lake becomes dry land. In this manner, the United States has lost about half the lakes which existed on this continent some 12,000 years ago.

Where human habitation around a lake is relatively sparse, its waters can endure the minor damage contained in the wastes and debris thrown into it. The waters can assimilate a certain amount of wastes by decomposing them into harmless chemicals and dispersing them. But there is a limit to what a lake can absorb.

As ever-greater numbers of people and industry congregate around a lake and pour increasing amounts of waste into the water, the lake may become saturated and unable to purify itself. Man often does not realize the damage he has done until the lake begins to smell and the physical characteristics of pollution become obvious. By then, the pollution problem is already well past the stage of an easy solution.

Lake Erie is one of the most flagrant and frequently cited examples of lake pollution and eutrophication in this country. A look at its history and development is needed to help us understand the problem—and to prevent its recurrence elsewhere.

Lake Erie is the oldest, the Southernmost and the warmest of the five Great Lakes. It is only 241 miles long and has the smallest volume of water, with almost a 10,000-square mile surface area. The lake is very shallow, with an average water depth of only some 58 feet, and at its deepest point is only about 210 feet.

But Lake Erie also happens to be in the heart of one of America's greatest residential and industrial areas. It provides a resource to 11½ million people in the United States and Canada in terms of water supply, recreation, commercial fishing and shipping. And the annual value added by manufacturing in the Erie Basin stands at more than $17 billion.

By the year 2000—and, remember, that's only 30 years from now—the population of the Lake Erie area is expected to double, and so is the volume of industry in the Basin. These people and industries will depend on Lake Erie—a lake whose water quality must be maintained and enhanced so it can be passed on in a condition of unlimited usefulness.

As it now stands, Lake Erie is close to being strangled by the pollutants which pour daily into its waters. Municipal wastewater is the principal cause of pollution in the lake and its tributaries, with industrial wastes also occupying a major role, particularly in tributaries and harbors.

Among the most harmful discharges are untreated flows, combined sewer overflows and treatment plant effluents. Agricultural runoffs also leave their marks, as do wastes from commercial and pleasure craft, harbor dredging, urban runoff and soil erosion.

The wastes most destructive to lake Erie come from three major geographic areas. These are Detroit, Michigan, and the Cleveland-Cuyahoga and Maumee River basins in Ohio. Waste inputs from the Buffalo area affect the Niagara River more than Lake Erie, but a number of other areas have local problems which add up to significant pollution for the lake.

The three major sources of pollution in Lake Erie together discharge about 74 per cent of the phosphorous flowing into the lake, 87 per cent of the biological oxygen demand and 66 per cent of the chlorides.

The total BOD discharged to municipal sewage treatment plants in the Lake Erie Basin is equivalent to the raw sewage produced by 9.4 million people. After treatment, this volume is reduced to a load on the receiving waters equal to the raw sewage of 4.7 million people. In effect, this means basin-wide sewage treatment has an efficiency of about 50 percent.

Only about half of the 360 known sources of industrial wastes in Lake Erie and its tributaries can be classified as providing adequate treatment for their wastes. Yet together these industries account for 87 per cent of the total waste flow discharged into the lake or its tributaries.

The total industrial flow amounts to 9.6 billion gallons daily, with electric power production account for 72 percent and steel production 19 percent of the total. The steel, chemical, oil and paper industries discharge about 86 percent of the total industrial wastewater in the basin, excluding the electric power installations.

There are so many sources of pollution to Lake Erie that it is almost impossible to make an accurate record of all of them. However, the combined sewer systems of the cities of Detroit, Cleveland and Toledo are among the worst offenders, and just their overflows alone annually contribute wastes equivalent to the BOD of raw sewage from approximately 600,000 people. These combined sewer overflows are expected to represent a high percentage of future phosphorous contributions to the lake.

As you know, phosphorous is a major contributor to the process of eutrophication because of its stimulation to the growth of algae.

It only takes a small amount of phosphorous to create the conditions which precipitate algal growth. As little as 0.01 milligrams per liter at the beginning of the growing season in some lakes or an annual inflow of 0.2 to 0.5 grams per square meter of lake surface in others is all that is necessary.

And unlike nitrogen—which also contributes to this problem—phosphorous does not enter into the type of biochemical reactions that permit it to escape from water as a

Fig. 1 - Algae on shore and in lake, near Washington, D.C., indicate water is aging.

gas, nor is it easily removed from the system by organisms or sediments.

With present technology, the preferred way to control eutrophication is to impede plant production by making phosphorous less available for growth. And one important step in this direction is to reduce the amount of phosphorous-bearing effluents.

A certain amount of phosphorous is contained in the Earth's crust and enters surface waters from many natural sources. These include surface water runoff, soil erosion, waste from, and decay of, plants and animals, and dissolved and suspended materials in rain and snow.

Thus, over the course of hundreds and thousands of years, these small, but continuing inputs of phosphorous can by themselves bring lakes to an end through eutrophication and sedimentation—without man entering into it. The Green River oil shales of Colorado, Wyoming and Utah are a good example of lake deposits formed by natural eutrophication and sedimentation over a long period of time.

But man also produces significant amounts of phosphorous, and because of the tremendous population rise in recent years, and even greater increases predicted for the immediate future, his contribution to the eutrophication process is becoming a major challenge.

Municipal sewage contains considerable concentrations of phosphorous. It comes principally from phosphorous-bearing detergents and from human wastes. On the average, adult humans contribute about 1.4 pounds of phosphorous a year, while the use of detergents adds another 1½ to 2 pounds of phosphorous per capita annually. While some of the phosphorous is removed by conventional waste treatment processes, substantial amounts are discharged with no treatment at all.

The phosphorous used in detergents currently makes up some 50 to 60 percent of the total amount of phosphorous in municipal sewage. Obviously, this constitutes a major source of nutrient pollution which must be abated.

Our primary thrust on controlling this problem has been the development and demonstration of phosphorous removal technology for application at municipal waste treatment plants. This approach has been given priority because it attacks all of the sources of phosphorous in municipal wastes, regardless of its origin. We want to emphasize the fact that we are not out to throttle the detergent industry. Phosphate removal technology would have to be applied to municipal waste waters even if phosphates in detergents were to be completely eliminated from use.

The only roadblock that stands in the way of requiring the reduction or elimination of phosphorous from detergents at this time is that a substitute material has not yet been adequately tested which performs the same function as phosphorous. Until it can be proven that such a product will not cause some problem equally harmful to the environment, a substitute probably will not be placed on the market.

The Interior Department effort to clean up our lakes and other waterways is a continuing one, which we hope to expand, in order to demonstrate the restoration possibilities for all our water resources.

In Lake Erie, the existing backlog of unmet restoration needs includes the upgrading of sewage treatment by no fewer than 287 municipalities. The Lake Erie Basin should actually be served now by treatment sufficient to provide a minimum of 85 percent BOD removal, the almost complete removal of suspended solids and 92 percent removal of total phosphorus. It is to be anticipated that by 1990 the removal of over 95 percent of organic pollutants will be required throughout the Basin.

At present, there are some 189 industries which still have not installed treatment facilities sufficient to meet water quality standards. This situation is hardly excusable, and it shows we still have a long way to go just to conform to the pollution control regulations that are already on the books.

Our primary consideration must be to stop putting nutrients into our lakes. We must slow down the eutrophication process or we may discover our water resources becoming unusuable. We must also devise ways and means to reverse the entire eutrophication process to assure future generations of lasting sources of water.

In the Interior Department, our strategy is twofold: it consists of prevention and restoration. By prevention, we mean slowing

Fig. 2 - Scum and plant growth on Island Grove Pond, Abington, Mass. Overgrowth of algae spells death to other life, especially fish, in slow-moving water.

down eutrophication by removing key nutrients from wastewater before it enters a lake. At the same time, research and development must be carried on to find even more effective methods of nutrient removal.

Restoration means removing or inactivating nutrients after they have reached a lake. Restoration techniques must be carefully researched to find an economically acceptable method that is likely to succeed.

The mechanical harvesting of algae, the harvesting of organisms which eat algae and eliminating the effects of algae by chemical means are among the techniques being studied intensively by the National Eutrophication Research Program of Interior's Federal Water Pollution Control Administration. This work is being done in government and university laboratories, as well by private industry, and often uses small lakes in various parts of the country as field laboratories.

It is altogether doubtful whether Lake Erie could ever be returned to the condition which existed prior to man's appearance, or even to the condition which existed at the turn of the century. It can, however, be returned to some intermediate stage of aging, and we can expect a major improvement and protection of water quality.

Lake Erie and others threatened by eutrophication can be saved, but it can be done only with the continued and determined support of the public and its political representatives.

President Nixon set the tone for our efforts to control pollution in his State of the Union Message last January and in programs he launched in February to carry them through.

The President said, "The great question of the seventies is, shall we surrender to our surroundings, or shall we make our peace with nature and begin to make reparations for the damage we have done to our air, our land and our water?"

While, "The price tag on pollution control is high . . ." the price will be even higher if we fail to act. That is why we at the Interior Department are determined to act now while there is still time.

Fig. 3 - An Arkansas creek.

Fig. 4 - A surface blanket of filamentous green algae covers a large area of this river near Washington, D.C. These algae could be Spirogyra, Zygnema, Oedogonium, or Cladophora. (Photos: FWPCA)

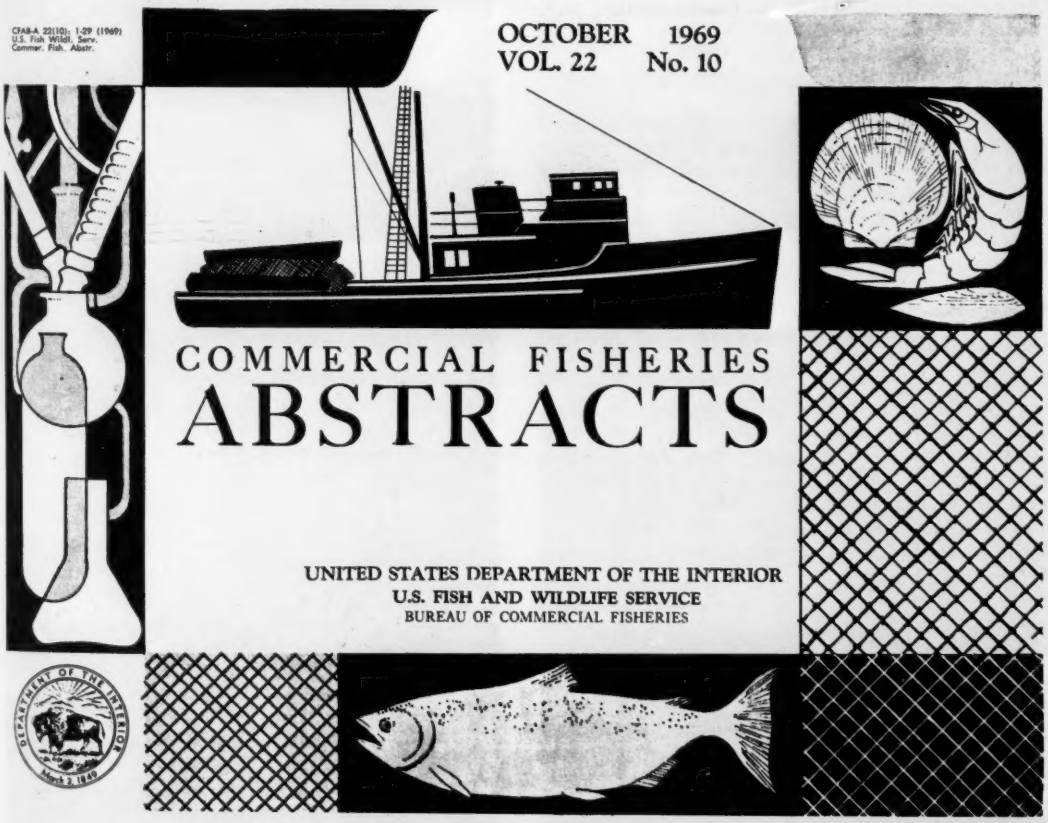
'COMMERCIAL FISHERIES ABSTRACTS'

Commercial Fisheries Abstracts, a monthly journal, contains summaries of selected articles from about 350 trade, engineering, and scientific journals dealing with the entire spectrum of our fishery industries. These journals cover the biological, physical, and social sciences and the engineering, technological, and legal aspects of the aquatic resource supply, harvesting, processing, use, and distribution. The abstracter classifies each abstract into one of 10 main fields and further into basic subject groups in accordance with a classification system designed by BCF. Whenever possible, the abstracter includes sufficient information in each abstract to enable the reader to understand and use the results of the research described in the original article. In addition, he gives pertinent bibliographic information so that the reader can obtain the original article from a library or the author.

Commercial Fisheries Abstracts is designed to serve the needs of fishery scientists, engineers, and managers in industry, academic institutions, and government by supplying timely information on current progress in fishery research and technology.

For free copy, write to: BCF, Division of Publications, Bldg. 67, U.S. Naval Air Station, Seattle, Wash. 98115.

Frank T. Piskur, Editor



OCEANOGRAPHY

SEA TEMPERATURES MEASURED BY SATELLITE

The results of an oceanographic survey called "Little Window," conducted March 17-22, may show that ITOS, a new meteorological satellite, can measure the temperature of water at the sea surface as well as watch the weather. This was reported by Dr. A. R. Longhurst, director of the BCF laboratory in La Jolla, Calif.

"Little Window" was an oceanographic survey of a 60 by 30 mile square, or window, in the Gulf of California to test the ability of infrared sensors on ITOS to measure sea-surface temperatures from space. It was a cooperative effort of BCF, ESSA, NASA, Inter-American Tropical Tuna Commission, U.S. Naval Oceanographic Office (NOO), and the Mexican Navy and Weather Office.

Oceanographic Survey Lines

U.S. Government scientists working from BCF's research vessel 'David Starr Jordan' and a Mexican Navy corvette spent March 17-22 running a series of oceanographic survey lines across the mouth of the Gulf of California. The temperature information collected from Jordan will be compared to infrared readings simultaneously collected by the satellite during its twice daily pass over the area. A single track requiring more than 30 hours by ship can be seen in seconds by the satellite.

The project was coordinated by NOO oceanographer Paul E. LaViolette from the BCF laboratory. He said: "We can use infrared data collected by these polar-orbited satellites for just about any ocean in the world. The biggest limitation is cloud cover, but with the satellite's ability to look repeatedly at an area, we can 'see' the ocean, if we wait long enough."

Results May Be Valuable

The results of the "Little Window" survey may show that satellites can furnish a continual source of sea-surface temperature for any ocean of the world. Such information would have many practical applications: for the fishery scientist, who would use it to predict distribution of temperature-oriented fish, such as the tunas; for the meteorologist, who studies warm and cold ocean fronts and their relationships to short-period meteorological changes, and who is looking towards reliable long-range weather forecasts; for the oceanographer, who has been searching for a quick way to look at temperature conditions at the sea's surface.

The oceanographic ability of a second satellite, NIMBUS III, was also evaluated. The infrared sensor aboard NIMBUS III differs from those of ITOS because it operates at a different frequency and can measure the ocean's temperature only at night.

ORGANISMS THAT FOUL VESSELS CAN ALSO DETECT POLLUTION

Major problems facing ships everywhere are the marine plants and animals, such as barnacles, that attach themselves permanently to marine hardware. This problem costs the U.S. Navy alone $50-$100,000,000 a year.

Two biologists of the U.S. Naval Oceanographic Office (NOO)--John DePalma and Ed Long--use these "biofoulers" for useful purposes: to warn of encroaching water pollution.

They have found that in populated marine areas, particularly near naval bases, local species of marine biofoulers may serve as indicators of the amount of pollution in the area waters.

Biologists' Explanation

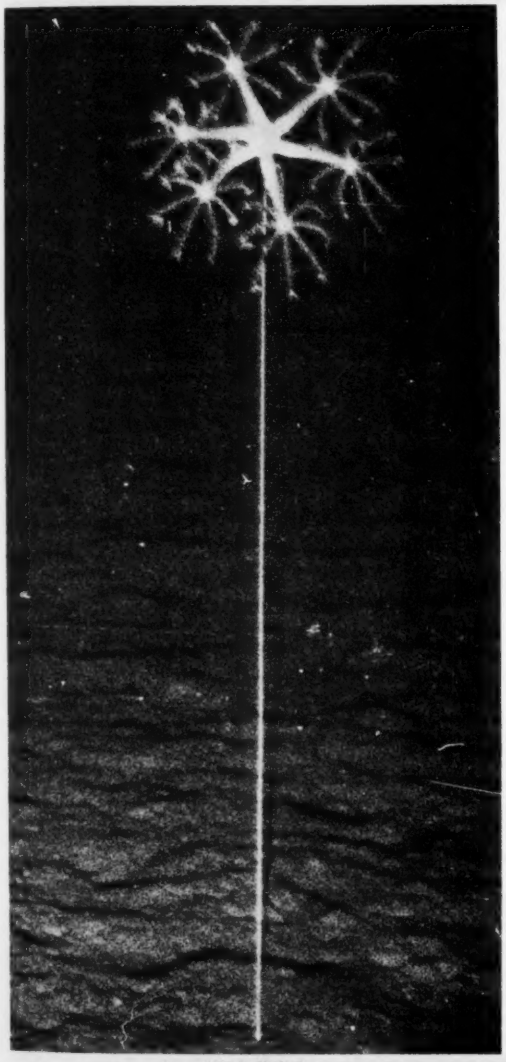
Long explained: "For instance, by examining the different species of biofouling plants and animals that attach themselves to test panels in the Wakiki-Pearl Harbor area, we would be able to tell how pollution from the Navy base in Pearl Harbor may be affecting the beaches at Wakiki."

DePalma added: "This is possible because we know that species diversity is lowered in direct relation to the amount of pollution in the area. By keeping track of species that we know from previous testing to occur only in, say, the Wakiki area, we can study the mean sizes of certain indicator species which vary directly with the distance from the source of pollution. Regular studies of the fouling in areas near naval bases could provide a sort of warning system for the Navy. Now is when we should be getting data, while the situation in places like Wakiki is not yet troublesome."

SCIENTISTS SEE RARE MARINE ANIMAL WITH SPECIAL CAMERA

"In the photograph, it looks like an exotic flower growing alone on a moonlit desert, but it isn't," explains Water Jahn, the U.S. Naval Oceanographic Office scientist who used a deep-sea strobe camera to take the photo. "It's actually a very primitive animal."

The creature was photographed on the sea floor 15,900 feet below the USNS 'Kane' when the NOO-controlled oceanographic survey ship stopped at a survey point about 350 miles west of the African coast.

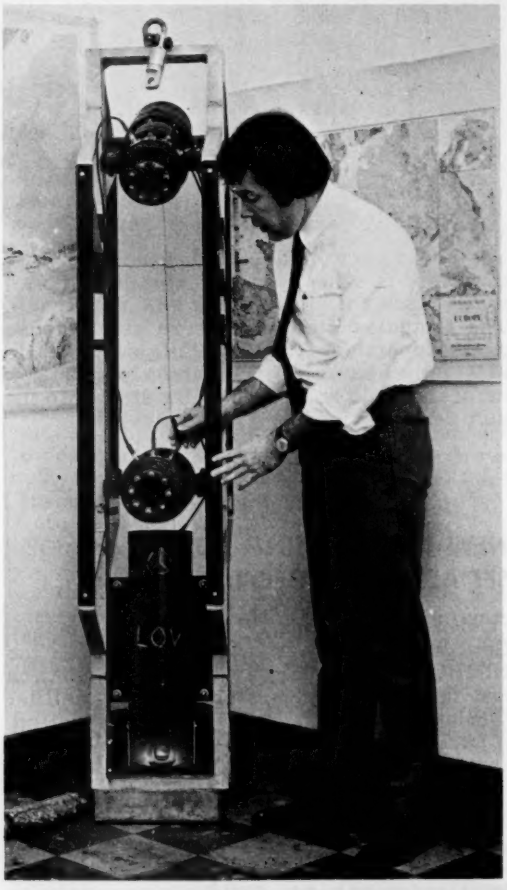


"Umbellula"

Long-Stemmed Polyp

To determine "what type of animal," Jahn sent his photo to marine biologists, who identified it as a member of Phylum Cnideria (Ceolenterate), class Anthozoa, subclass Alcyonaria, Order Pennatulacea, family Umbellulidae. That means it is a long-stemmed polyp--a multicelled animal akin to hybroids, sea anemones, and living coral.

The biologists told Jahn it was the first time they had seen this variety actually living on the ocean bottom, although they knew it existed.



Mr. Jahn and his camera.
(Photos: U.S. Naval Oceanographic Office)

Study Origin of Oceans

NOO officials said this probe was designed "to test theories that are relevant to the origin and history of all the world's oceans--theories that will help the Office interpret existing geologic structure and trends." Such understanding could become a scientific base for diagnosing the meaning of soundings and other survey data. NOO uses this information to chart the lands lying beneath the world's oceans and seas.

Like all deep-ocean regions, the sea floor beneath the open Atlantic is largely unexplored--at least as far as photographing it is concerned. So, Jahn recalled, "we lowered the camera to the bottom at 77 different Atlantic stations to get random shots--to see what could be found, and the 'Umbellula' (his name for it) appeared on Station 59."

The 'Umbellula'

The photo shows the Umbellula as a tentacled animal atop a slender stalk, which Jahn estimates to be about three feet long. The tentacles end in clusters of large flower-like polyps, or "feet," said to be deep red, shading toward orange-red or purplish red.

"These agile tentacles," Jan reports, "capture food floating by the Umbellula and pass their catch to the creature's center mouth. The tentacles also may serve as a defense against enemies. The Umbellula supports itself on the bottom by imbedding a long, hollow muscular bulb at the end of its stem into the soft sea floor mud."

NEW-TYPE DRIFTING BUOY SET ADRIFT ON GEORGES BANK

BCF's 'Albatross IV' set adrift a buoy on Georges Bank in March. On command of the NIMBUS satellite, the buoy radios its position and the water temperature to the satellite. The latter radios the data to a ground station. A series of such positions traces the surface current.

The Woods Hole (Mass.) Oceanographic Institution is responsible for U.S. Navy-developed buoys. The Institution requested BCF's Woods Hole Laboratory to select the location for the buoy. It did--in an area over the haddock spawning grounds.

□□□□□□□□

ANTARCTICA ONCE JOINED TO S.E. AFRICA, SCIENTISTS SAY

Two ESSA scientists, Dr. Robert S. Dietz and Walter Sproll, report they have established with a computer's help, that Antarctica once was attached to Africa's southeast coast. The continents now are 2,000 miles apart.

About 200 million years ago, they estimate, there was only a single universal land mass called Pangaea, 80 million square miles in area. Then, for still-unclear reasons, Pangaea started to rift apart, like an ice floe breaking up. The fragments--today's continents--were dispersed to their present positions. The split between Africa and Antarctica apparently was one of the first events to occur.

Support Continental Drift Theory

Dietz and Sproll support the continental drift theory. This postulates that the continents are drifting at rates of about an inch a year in the earth's mantle. The mantle is that part of the earth's interior lying between the molten central core and the crust.

COMPUTER USED TO STUDY WORLD'S OCEANS

Scientists are using a computer at the National Oceanographic Data Center (NODC), Washington (D.C.) Navy Yard, "to unravel many of the mysteries locked in the cold and silent depths of the seas." Its electronic files contain an estimated 85% of world's known oceanographic station data, and are the largest collection of such information in the U.S.

The computer helps "chart the paths of 'rivers' that flow through the sea, measure the closely related effects of the world's oceans on global weather, even track the life cycle of a single drop of sea water."

Many Requests for Data

"A few months ago," said Dr. Thomas S. Austin, Director of the Center, "a scientist asked for all our data on a triangular section of the Atlantic from Gibraltar to the Azores to the coast of Scotland. He wanted readings from the surface down to 10,000 feet.

Dr. Thomas S. Austin (center), Director, National Oceanographic Data Center, James Pugh, computer operator, and Mrs. Charlotte Sparks, a programmer, with IBM System/360 Model 40. Its electronic files contain the largest U. S. collection of oceanographic station data.

"With this kind of information, he plotted the two-way flow of water into and out of the Mediterranean--eastbound for the upper layers of the water and westbound as the water gets deeper."

In another case, the Center's information on the effects of polar icecaps was needed. The freezing action in Arctic and Antarctic areas removes salt from water and makes it heavier. Then, the colder, heavier water flows along layers of equal density. It results in the creation of 'rivers' of colder water coursing along the ocean bottom.

Dr. Austin points out: "A drop of seawater has a life cycle that can be traced with information stored in the IBM computer."

The cycle can take thousands of years. It starts with the chemical combination of hydrogen and oxygen in the atmosphere as precipitation. "Precipitation enters the seas directly as rain, fog, or mist, or through runoff from rivers. It completes the cycle through evaporation by the sun."

NODC's Many Sources

NODC's information comes from many sources: world's navies, private shipping, scientists, oceanographic vessels, government agencies, and oil companies.

According to Dr. Austin, the data's completeness, currency, and availability are the system's key elements.

Nansen Bottles & Other Devices

Until recently, water samples were gathered mostly in Nansen bottles lowered by cable over the side of a ship. The bottles also have thermometers to take temperatures at

various depths. The analysis of the contents of these samples yields information on the amounts of nutrients and chemical elements, the presence of plankton and other small marine life, and the subsurface currents' direction and speed.

In the past few years, the use of sophisticated continuous-recording devices on ships, buoys, and satellites has increased. Also, more computers aboard oceanographic vessels have increased information supplied to NODC.

The National Oceanographic Data Center, founded 9 years ago, is sponsored by 10 government agencies and administered by the U.S. Naval Oceanographic Office.

EXTRA-HOT PANAMA BASIN OF PACIFIC IS STUDIED

Oceanographers of ESSA's Coast and Geodetic Survey, aboard the 'Oceanographer', this month are seeking "answers to one of the earth's most puzzling riddles."

They are studying the welling up of heat from within the earth's bowels. This heat warms the water below the sea as it moves northward from the frigid Antarctic.

Scientists know little about the process by which this thermal energy moves upward after it escapes the earth's crust. But the basin ESSA's oceanographers are probing provides an unusual laboratory.

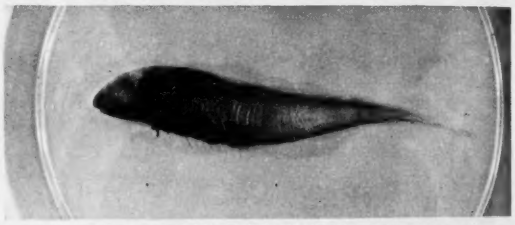
The Panama Basin

It is a 600-by-600 mile, 9,000-foot-deep, basin at the bottom of the Pacific, hemmed in by undersea mountains, and known as the Panama Basin. ESSA says: "The heat that rises in it from within the earth is estimated to be three times greater than the average rate elsewhere in the world's oceans. Furthermore, the basin floor is marked by abrupt pit-like deeps, ridges and escarpments which provide a wide range of conditions for examining the circulation phenomena."

The Panama Basin lies between the coasts of Central and South America and the Galapagos Islands. The islands are on the equator, about 600 miles west of Ecuador.

DEEP-SEA EXPEDITION CATCHES RECORD FISH

A depth record for collecting a vertebrate from the deep sea has been claimed by the crew of the 'John Elliot Pillsbury'. A fish of the genus Bassogigas was trawled from 26,132 feet, nearly 5 miles down, in the Puerto Rico Trench. The Pillsbury expedition was part of the National Geographic Society/University of Miami Deep-Sea Biological Program directed by Dr. Gilbert L. Voss and Dr. Frederick M. Bayer of Miami's Rosenstiel School of Marine and Atmospheric Sciences.



Bassogigas--trawled from 26,132 feet by R/V Pillsbury. (Photo: Don Heuer)

Dr. Voss, expedition's chief scientist said: "Only three or four specimens of Bassogigas are known in world biological collections, and our specimen is in the best condition of any that have been collected, as well as having been taken from the deepest water." The fish is about $6\frac{1}{2}$ inches long and, though it inhabited an area of total darkness, has two small eyes.

The remains of a squid which probably had reached 15 to 18 feet also were collected from the Puerto Rico Trench. The scientists say it is the first-known record of the carcass of a large animal taken from the ocean deeps.

The scientists say the Pillsbury is the only vessel in the U.S. oceanographic fleet fully equipped for trawling at these depths. Her main winch has two reels of $\frac{9}{16}$-inch wire; each reel contains 42,000 feet. As much as 35,840 feet were used to make the tows.

Pollution $4\frac{1}{2}$ Miles Down

The Pillsbury's scientists reported: "Man's efforts to pollute the earth were evidenced by some of the other items brought up when tows were made in water $4\frac{1}{2}$ miles deep. From the ocean bottom came empty paint cans, fruit juice cans, flip-top lids of beer cans, clinkers from steamship fire-rooms, pieces of old aluminum, empty bottles, and flashlight batteries."

Puerto Rico Trench

The level floor of the Puerto Rico Trench consists of soft, blue, extremely sticky clay. "The clay is covered with the largest amount of land plant material yet reported from any trench in the world. Pillsbury tows brought up coconut husks, tree seeds, fronds, tree branches, mangrove roots, and turtle grass remnants."

The Trench probably has "the most uniform, unchanging environment known in the Atlantic Ocean." At $4\frac{1}{2}$ to 5 miles down, there is no light from the sun, temperature is slightly below 2° C., and pressure is 800 times greater than on earth's surface. The Trench is over 200 miles long; at its widest point, it is almost 40 miles. At its deepest, the Milwaukee Deep, it is about 28,700 feet (4,780 fathoms).

The National Geographic Society/University of Miami Deep-Sea Biological Program investigates "the kinds, distribution, and concentration of marine life in the tropical waters of the Atlantic Ocean from West Africa to the coast of South America and the Caribbean Sea."

DR. J. L. McHUGH APPOINTED IDOE COORDINATOR

Dr. J. L. McHugh, the former deputy director of BCF, has been appointed head of the new Office for the International Decade of Ocean Exploration (IDOE) by Dr. William D. McElroy, director of the National Science Foundation.

The IDOE is an international effort to expand the uses of the oceans--and to design ways to protect the marine environment from degradation.

IDOE's first year will concentrate on three areas: identification of factors that will help man predict modifications in the oceans caused by nature or by man; investigation of specific oceanic areas with special attention to food chains and pollutants; and studies of selected areas of the ocean bottom to improve man's knowledge of it, and to facilitate location of natural resources.

Dr. J. L. McHugh

FOREIGN FISHING OFF U.S. IN FEBRUARY 1970

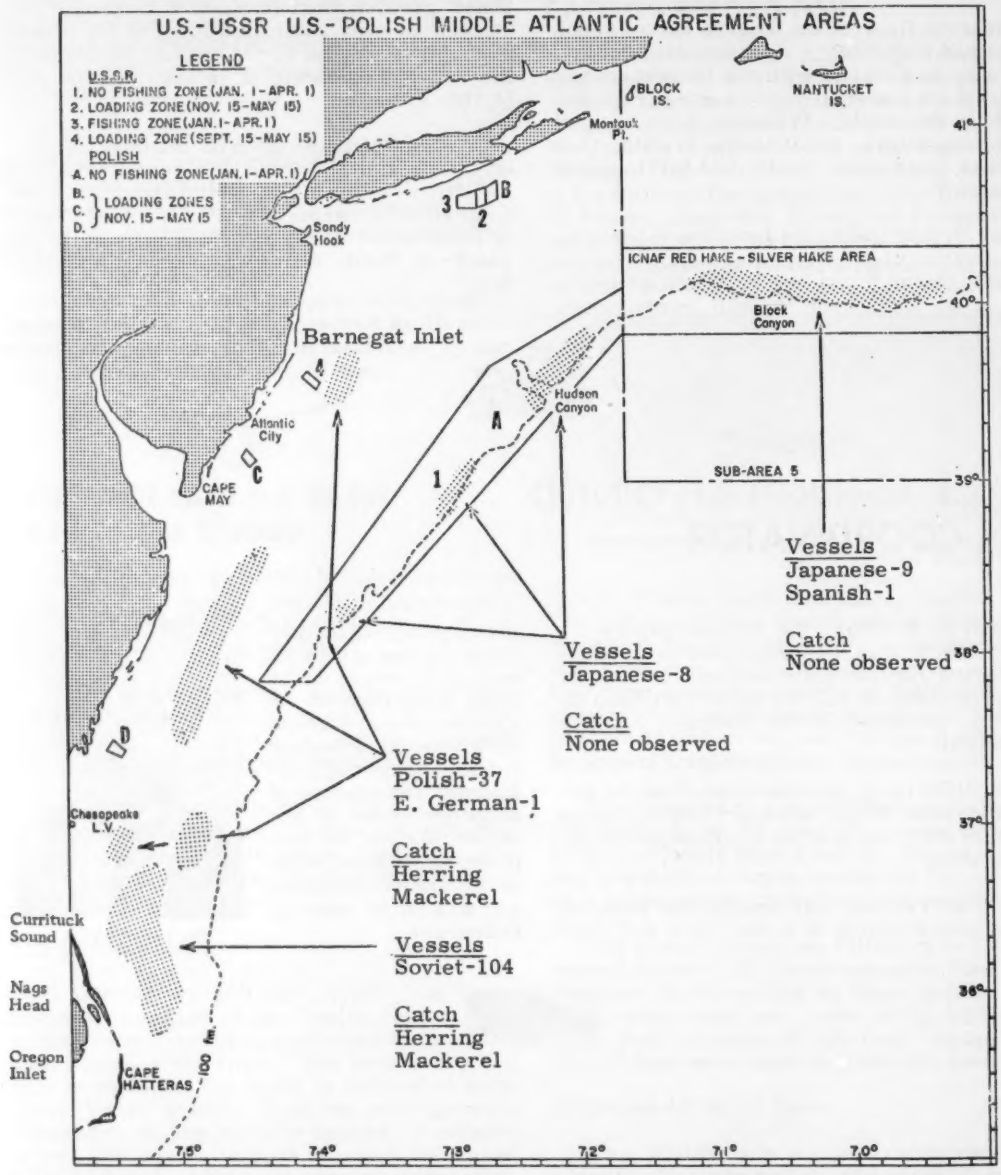


Fig. 1 - Foreign-flag vessels fishing off southern New England and Georges Bank, Feb. 1970 (shows no. of vessels and species fished).

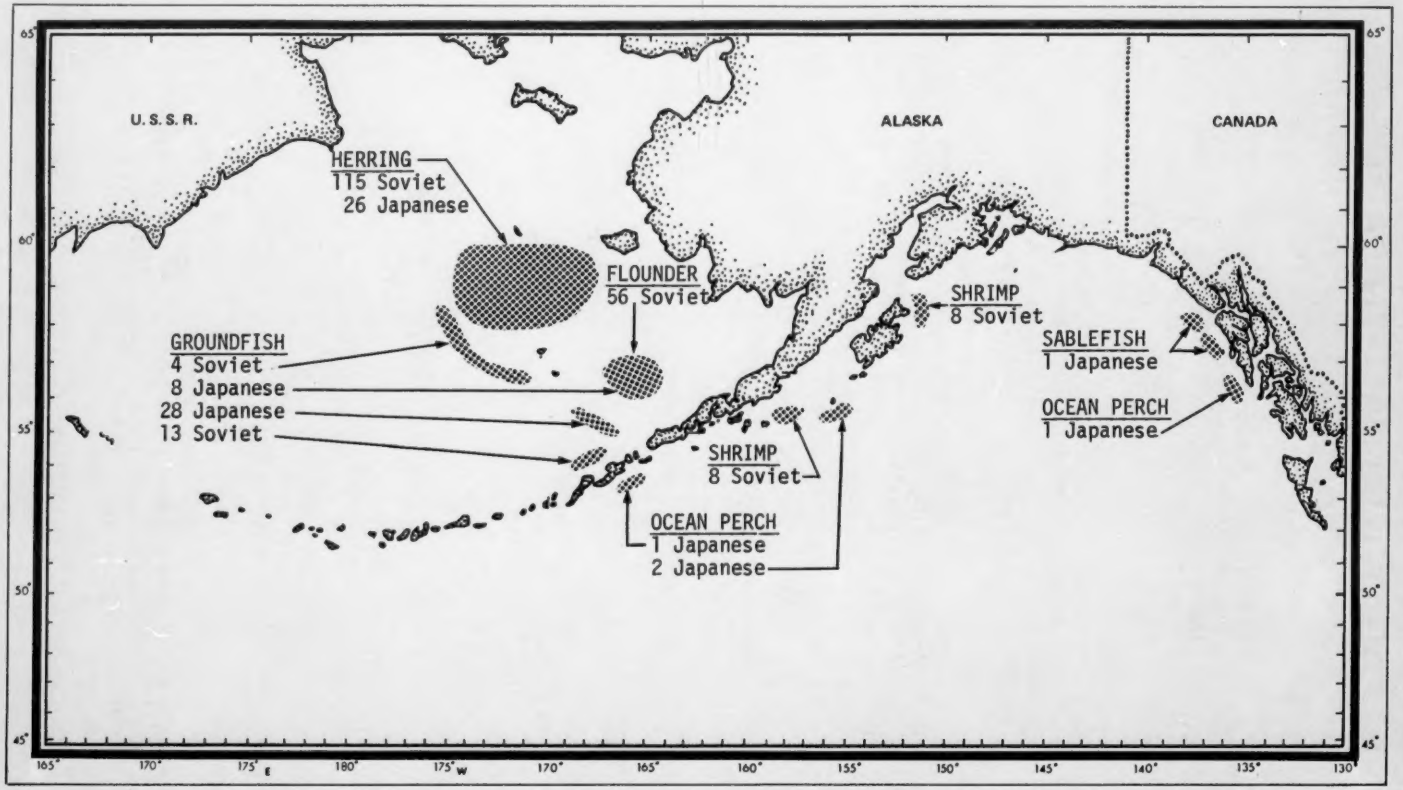


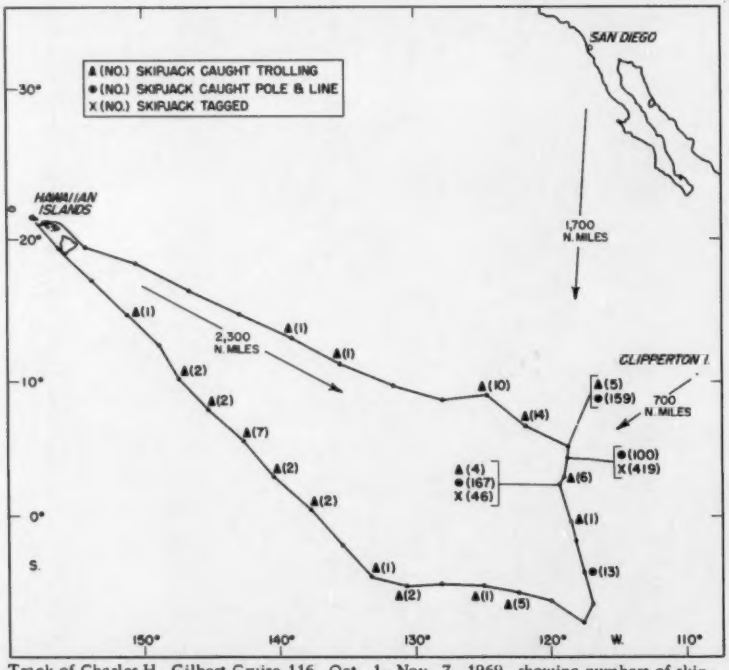
Fig. 2 - Foreign fisheries off Alaska, February 1970.

SURFACE TUNA SCHOOLS LOCATED & FISHED IN EQUATORIAL EASTERN PACIFIC

Thomas S. Hida

Large bird flocks, breezing schools of skipjack tuna, and mixed schools that included yellowfin and bigeye tunas were encountered about 700 miles southwest of Clipperton Island by the BCF research vessel 'Charles H. Gilbert' in October 1969. The vessel returned to Honolulu on November 7 after completing a 5-week voyage. Her primary mission was to collect samples of surface-swimming skipjack and yellowfin tunas for a subpopulation study. Detailed accounts of the schools fished are presented here because there are very few reports of schools in the area surveyed.

On a cruise to the equatorial waters of the eastern Pacific, Oct. 1-Nov. 7, 1969 (fig.), the research vessel Charles H. Gilbert of the BCF Biological Laboratory, Honolulu, encountered numerous schools of surface-swimming tunas far from land. The primary mission of the cruise was to collect surface-swimming skipjack tuna (Katsuwonus pelamis) and yellowfin tuna (Thunnus albacares) for subpopulation analysis. Although the 259



Track of Charles H. Gilbert Cruise 116, Oct. 1- Nov. 7, 1969, showing numbers of skipjack tuna caught, and number tagged, at different localities.

Mr. Hida is Fishery Biologist, U.S. Bureau of Commercial Fisheries Biological Laboratory, Honolulu, Hawaii 96812.

U.S. DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service
Reprint (Sep.) No. 868

Table 1. - Noon Positions, Dates, and Number and Kinds of Schools Sighted During Cruise 116 of the Charles H. Gilbert

Noon position		Date 1969	Number of schools sighted						
Lat.	Long.		Skipjack tuna	Unidentified	Mixed	Porpoise	Bigeye tuna	Mahimahi	Yellowfin tuna
On run to main area									
19°28' N.	156°10' W.	10/3	3	1	-	1	-	-	-
17°05' N.	153°45' W.	10/4	-	-	-	-	-	-	-
14°42' N.	151°04' W.	10/5	-	-	-	-	-	-	-
12°37' N.	148°45' W.	10/6	-	1	-	-	-	-	-
10°04' N.	147°26' W.	10/7	-	2	-	-	-	-	-
07°47' N.	145°09' W.	10/8	-	-	-	-	-	-	-
05°39' N.	142°44' W.	10/9	5	7	-	-	-	-	-
02°52' N.	140°26' W.	10/10	-	3	-	-	-	-	-
00°30' N.	137°44' W.	10/11	-	3	-	-	-	-	-
02°05' S.	135°26' W.	10/12	-	2	-	-	-	-	-
Subarea									
04°27' S.	133°22' W.	10/13	1	1	-	-	-	1	-
05°03' S.	130°53' W.	10/14	1	2	-	-	-	-	-
05°00' S.	128°10' W.	10/15	2	-	-	-	-	-	-
05°09' S.	125°08' W.	10/16	2	2	-	-	-	2	-
05°36' S.	122°35' W.	10/17	2	1	-	-	-	2	-
Main area									
06°12' S.	120°02' W.	10/18	1	3	-	-	-	1	-
07°43' S.	117°58' W.	10/19	1	1	-	-	-	-	-
06°25' S.	117°05' W.	10/20	-	3	-	-	-	1	-
04°09' S.	117°47' W.	10/21	1	7	1/1	-	-	-	-
01°52' S.	118°21' W.	10/22	-	1	-	-	-	-	-
00°28' S.	118°43' W.	10/23	2	1	-	1	-	-	-
02°14' N.	119°29' W.	10/24	1	2	-	-	-	-	-
02°46' N.	119°10' W.	10/25	2	-	-	1	-	-	1
04°12' N.	118°58' W.	10/26	-	1	2/1	2	1	-	-
05°04' N.	118°56' W.	10/27	2	3	-	-	-	-	-
On return run									
06°37' N.	121°54' W.	10/28	1	3	-	-	-	-	-
08°54' N.	124°48' W.	10/29	-	1	-	-	-	-	-
08°36' N.	128°00' W.	10/30	-	6	-	-	-	-	-
09°33' N.	131°47' W.	10/31	-	4	-	1	-	-	-
11°16' N.	135°32' W.	11/1	-	-	-	-	-	-	-
13°03' N.	139°07' W.	11/2	-	1	-	-	-	-	-
14°52' N.	142°55' W.	11/3	-	-	-	-	-	-	-
16°26' N.	146°40' W.	11/4	-	-	-	-	-	-	-
18°13' N.	150°32' W.	11/5	-	-	-	-	-	-	-
19°33' N.	154°20' W.	11/6	-	1	-	-	-	-	-
Off Kewalo Basin		11/7	-	2	-	-	-	-	-
		Totals	27	65	2	6	1	7	1

1/Skipjack, yellowfin, and bigeye tunas.
2/Skipjack, yellowfin, and bigeye tunas and mahimahi and rainbow runner.

skipjack tuna and 42 yellowfin tuna collected will be invaluable in the subpopulation study, the cruise was also noteworthy for a different reason: Numerous surface schools of tuna were sighted far at sea, and skipjack tuna apparently were abundant. There are very few previous reports of tuna schools that have come from the area surveyed.

The Gilbert departed from Honolulu on Oct. 2, 1969, with 143 buckets of 2- to 3-inch-long threadfin shad (Dorosoma petenense) which were to be used as live bait in pole-and-line fishing. Fifty baskets of longline gear were also taken aboard. The longline gear was to be fished in the event bird flocks or fish schools could not be located, or the threadfin shad died before the vessel reached the fishing area.

The longline gear was never used. We saw bird flocks and schools of tuna daily in the area of operation, and the threadfin shad held up well. One hundred and nine schools were seen on the cruise (table 1). Most schools were accompanied by flocks of up to 300 birds (table 2), largely shearwaters and terns.

Although numerous schools were seen, pursued, and chummed when the vessel first entered the fishing area on October 13, none responded to chumming during the first 8 days of fishing. Before October 21, this was the usual sequence of developments after a bird flock was sighted: (1) change vessel course and pursue, (2) number of birds diminishes upon approach, (3) jig strike, (4) reduce vessel speed and start chumming, (5) abandon school--either fish were not skipjack tuna or no response, and flock dispersed. The schools sighted from October 13 to October 21 were moving fast and were probably small.

The Catch

The first school successfully fished by pole and line was encountered on October 21 at lat. 4° S., long. 119° W. This was a poor-biting school; the average weight of the 13 skipjack, 8 yellowfin, and 2 bigeye (Thunnus obesus) tunas caught was about 3 pounds.

Fishing improved as the Gilbert proceeded northward to about lat. 2° N. along long. 119° W. On October 24, 213 large (17-pound average) skipjack tuna were caught by pole and line; 46 were tagged and released. Since sample requirements for subpopulation studies were fulfilled, the school was abandoned, although the catch rate was still good.

Two schools were fished on October 26 at lat. 4° N., long. 119° W. The first was a large breezing school of small fish. ("Breezer" refers to a school that can be detected by a

Table 2. - Frequency Distribution of Bird Flock Sizes Seen on Cruise 116 of the Charles H. Gilbert

Number of birds in flock	Average number of flocks observed per day		
	In main area: lat. 5° N.-10° S. and long. 115°-120° W.	In subarea: lat. 5° S. between long. 120° and 135° W.	On runs to and from fishing areas
1-5	0.1	0.6	0
6-10	0.7	1.0	0.1
11-25	1.0	0.8	0.6
26-50	1.0	0.2	1.1
51-100	0.7	0.4	0.3
101-500	0.6	0.2	0.2
Total per day	4.1	3.2	2.3

light-to-heavy rippling of the water surface, similar to that caused by local wind disturbance or a rip current; see Scott 1969.) Pole-and-line fishing yielded the following species and average weights: 519 skipjack tuna, 5 pounds; 13 bigeye tuna, 4 pounds; 28 yellowfin tuna, 4 pounds; 6 mahimahi (Coryphaena hippurus), 16 pounds; and 1 rainbow runner (Elagatis bipinnulatus), 13 pounds. A total of 419 skipjack tuna was tagged and released. Many more bigeye and yellowfin tunas could have been caught had they not been shaken off the hooks by the fishermen during the 1 hour of skipjack-tuna tagging. This large school was still breezing and following the vessel when last seen at 1500, although fishing had stopped at 1230. The vessel was scouting at a reduced speed of about 3 knots after fishing the school to enable the field party to complete sampling of the catch.

The second school of the day to be fished was a large one of bigeye tuna (10-25 pounds) which was "boiling" the surface when approached. ("Boiler," a very active, feeding school that can be detected by the "boiling" white water caused by jumping fish in pursuit of their prey; see Scott 1969.) Ninety-seven were landed in a few minutes, and the fish were still biting fast when fishing was stopped. Representative samples of the stomach contents were preserved when it was found that the fish had been feeding on a small anchovy, not yet identified, that closely resembles the Hawaiian nehu (Stolephorus purpureus).

Two schools of skipjack tuna were fished on October 27 at about lat. 5° N., long. 119° W. The first was a school of medium-sized (10-pound average) fish that breezed frequently but bit poorly. This school was abandoned soon after the 10th pass when an adequate sample (49 fish) had been caught by pole-and-line.

The second school was a large breezing school of medium-sized (8-pound average) skipjack tuna. Although the bait supply was depleted in a few minutes, five fishermen in the racks landed 110 skipjack tuna; this was more than the sample size required for subpopulation studies. After exhausting the live-bait supply on this school, the Gilbert curtailed pole-and-line fishing and returned to Honolulu.

Surface Trolling

Surface trolling with two to six lines was conducted throughout the cruise on all daylight runs. The catch from about 400 hours of trolling (see fig. for areas) consisted of 67 skipjack tuna (1-25 pounds), 9 yellowfin tuna (2-4 pounds), 9 bigeye tuna (2-10 pounds), 22 mahimahi (1-30 pounds), and one 8-lb. wahoo (Acanthocybium solandri). Skipjack tuna seemed to be plentiful on 3 days during runs to and from the fishing areas, judging by the many strikes on the trolling lines. Twelve schools were sighted on October 9 while the vessel was en route to the fishing area, at about lat. 5° N., long. 143° W. During the return trip, seven skipjack tuna were caught on October 28, and 14 on October 29, between lat. 6° N., long. 122° W. and lat. 9° N., long. 125° W. Many more came off the hooks and were lost while being retrieved. The strikes on the trolling lines were spread throughout the day. Unless a tuna school followed the vessel during this period--a situation unlikely in view of the vessel speed of about 9 knots--the area appears to represent rich grounds for skipjack tuna. There was little doubt that pole-and-line fishing would have been very fruitful in these areas.

Although bird flocks and schools were seen throughout the fishing area, the best fishing was in the latitudes a few degrees north of the Equator, where surface temperatures were about 25°-28° C. The water was clear and blue in the fishing area. The thermocline depths usually ranged between 40 and 100 m., and currents setting easterly at a few knots prevailed in the better fishing area.

LITERATURE CITED

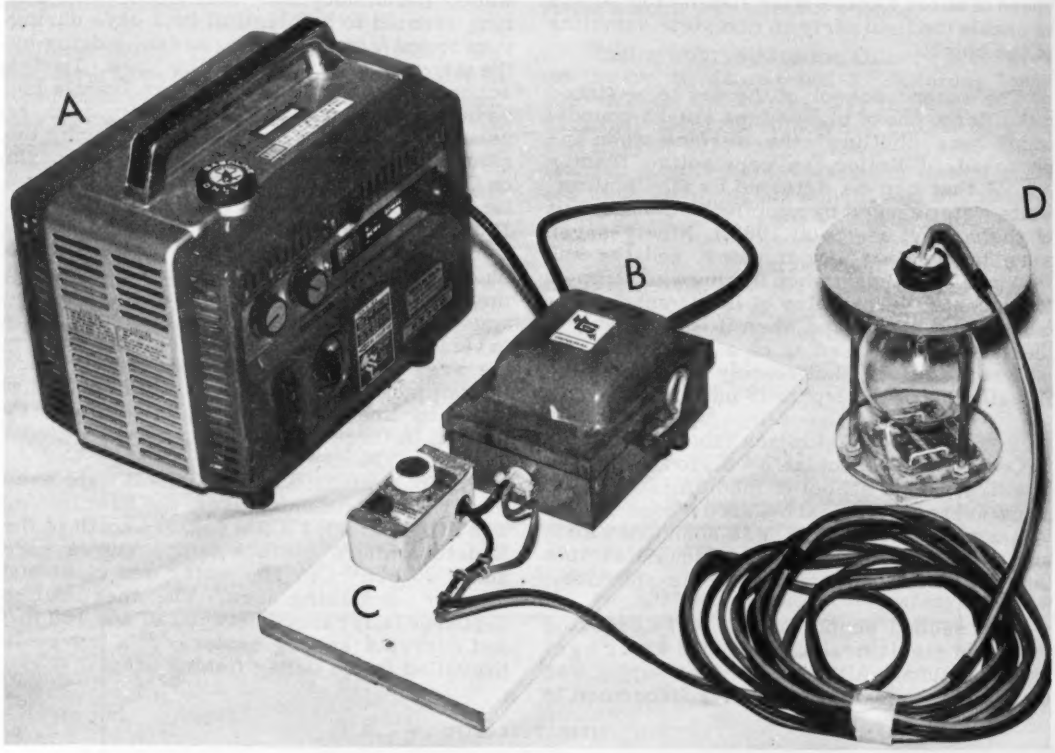
SCOTT, JAMES MICHAEL.
1969. Tuna schooling terminology. California Fish Game 55(2): 136-140.

NIGHT LIGHTING FOR HERRING-- AN OLD TECHNIQUE MAY HAVE NEW POSSIBILITIES

Alden P. Stickney

One of the most modern fishing techniques, which may also be as ancient as the art of fishing itself, is the use of artificial lights to attract fish at night. Several significant developments have contributed to the usefulness of this technique: the convenience and versatility of modern electric lighting equipment, new and ingenious methods of catching the fish, and a better understanding of fish behavior through research. At present, lights are used successfully in fisheries throughout the world.

The Atlantic herring (Clupea harengus) is one of many species that can be attracted to lights. Modern fishing vessels in several countries carry lights for this purpose, even though routine fishing may be carried on without them. In the United States, "torching" for herring is a very old method. Once it was used on the east coast, but now it is largely obsolete, although modern purse seiners on the west coast use lights very effectively for Pacific herring.



Experimental lighting gear used to attract herring at night.
A. 300-watt generator; B. Fuse box and switch; C. Dimming control; D. Waterproof lamp socket and bulb in weighted frame.

Mr. Stickney is Fishery Biologist, BCF Biological Laboratory, W. Boothbay Harbor, Maine 04575.

U.S. DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service
Reprint (Sep.) No. 869

Not Universally Accepted

The acceptance or belief in the efficacy of lights for catching herring is not universal among fishermen. Apparently, this stems from various local prejudices as well as the demonstrable fact that herring vary considerably in their response to lights. At the Bureau of Commercial Fisheries Biological Laboratory in Boothbay Harbor, Maine, experiments recently were conducted to learn more about the behavior of herring in response to lights. The hope is that this fishing method may provide a useful supplement to increase the flexibility of the New England herring fishery.

In recent years, a decline in the coastal sardine fishery of Maine, for example, seems to have resulted in part from behavioral and distributional anomalies that tend to reduce the availability of the herring schools. In some instances, particularly for the inshore stop seiners, a diversion of the schools by as little as a few hundred yards may mean the difference between a good catch and none at all. Even in the more flexible purse-seine fishery, slight differences in the depth or location of schools make significant differences in the ability of the gear to catch them.

Lab Experiments

Laboratory experiments[1/] at Boothbay Harbor have shown that the efficacy of a light in attracting herring is quite variable. It depends, among other things, on its brilliance, its location above or below the surface, the temperature of the water, and the physiological state of the fish. For this reason, some judgment is necessary in using a light effectively and, at times, using a light may be of doubtful value.

The Boothbay Harbor experiments showed that a very bright or very weak light is much less effective than one of intermediate brillance ;the optimum brilliance is dependent on the distance of the fish from the light. An underwater light is more effective than one above the surface, and any light seems more effective in cold water than in warm. Herring adapted to darkness are attracted less readily than those adapted to light; hence the use of lights would seem to be most advantageous shortly after sundown.

Lab Work Field Tested

Much of the experimental work was done in the laboratory, but field tests of an underwater light confirmed most of the laboratory conclusions. In trials during October-November 1969, a 250-watt incandescent bulb in a weighted watertight socket, lowered to a depth of about a fathom in 3 fathoms of water, attracted large numbers of herring and alewives. These results were achieved in a location usually providing good catches to stop seiners but which, for the past two years, has been relatively barren of fish. Fathometer recordings made during the day showed traces of small fish schools about 300 yards away from the location of the light. Shortly after sundown, when the light was turned on, fish began to appear within 15 to 60 minutes.

These tests did not give adequate information about the ability of the light to attract herring in commercially useful quantities. It is possible, however, that had such quantities been in the vicinity, they would have been attracted; also, that one or more such lights would have drawn them into an area in which they could have been caught more easily with conventional gear.

Research trials of underwater lights were made in 1966 by biologists of the Marine Biological Station at Grande-Riviere, Quebec, in the Gulf of St. Lawrence. In several trials, 25 to 40 tons of herring were attracted and taken in purse seines. Good catches were made in some instances when little or no indication of herring was shown on the fathometer.

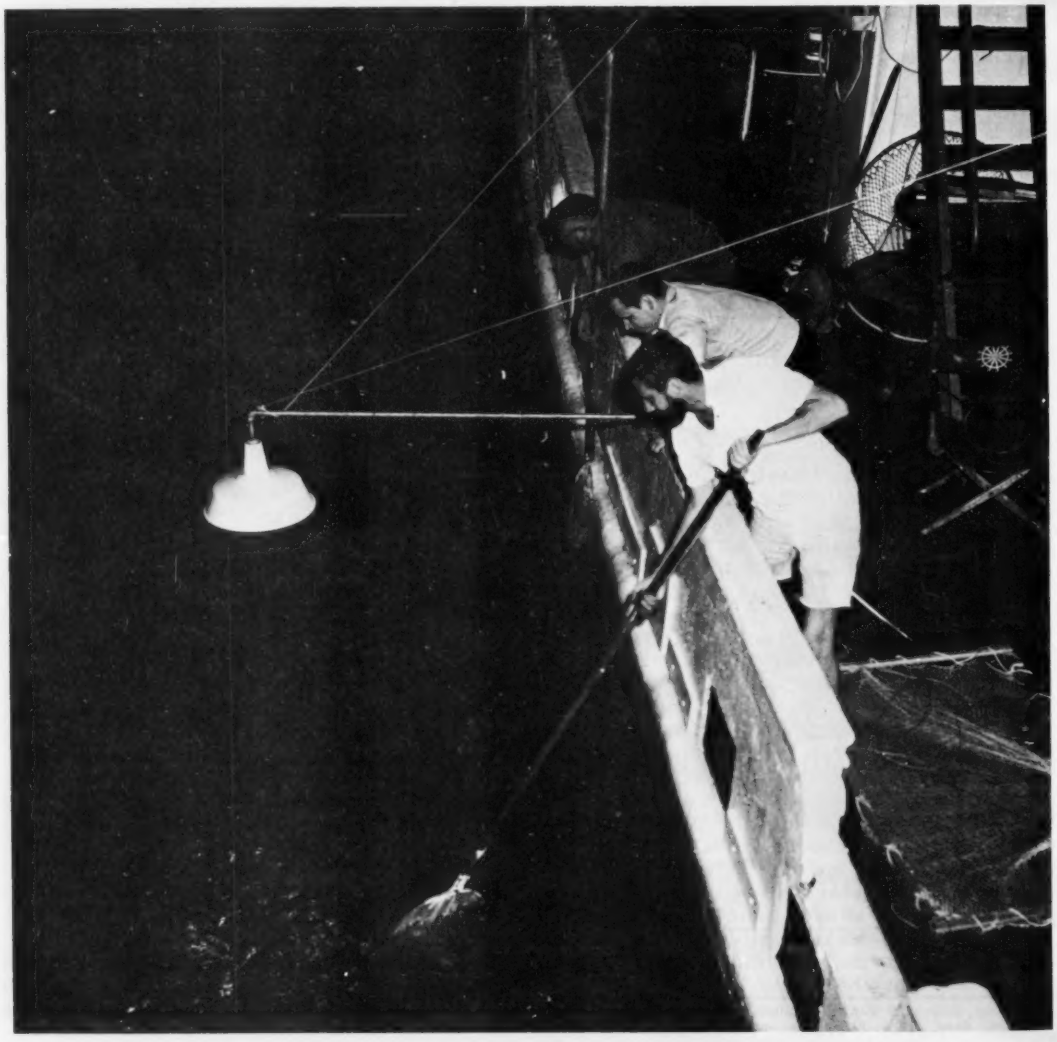
'Torching'

In the primitive method of "torching," an open flame is held in front of a moving boat. Although it is seldom used today, fishermen say it has yielded catches of as much as 60 bushels of herring in a few hours--using only a large dip net to capture the fish. There is some question as to whether the herring actually were attracted to the light, or whether they were already present in the water and were merely dazzled sufficiently to permit capture. Attempts to duplicate the technique with electric lights above the water generally have not been found satisfactory. In a comparison of a kerosene torch with an

1/Stickney, Alden P. Factors influencing the attraction of Atlantic herring, Clupea harengus harengus, to artificial lights, U.S. Fish Wildl. Serv., Fish. Bull., Vol. 68: 73-85.

underwater light, we found the latter to be far more effective in attracting herring.

For some purposes, underwater light gear need not be expensive. In our field tests, we used a globe-type, 250-watt light bulb in a watertight socket, weighted so it would sink (photo p. 38). A 300-watt portable generator, suspended from aloft or set on a cushion to minimize vibration, provided power. The light circuit was connected to the generator through a control panel containing fuses and a dimmer. As the wattage rating or number of lights increases, or for illumination at greater depths, more rugged and expensive equipment would be necessary.



Dip netting at a light attraction station aboard the BCF research vessel 'Oregon.' (Photo: T. Iwamoto)

FISHING LIMITS

"Limits and Status of the Territorial Sea, Exclusive Fishing Zones, Fishery Conservation Zones and the Continental Shelf," FAO Legislative Series No. 8, $1. Sold by UNIPUB, Inc. 650 First Ave., P.O. Box 433, New York, N.Y. 10016.

This is a new listing of national claims on territorial seas, fishing and conservation zones and adjacent waters, and the Continental Shelf. It covers 106 countries and territories and is a convenient reference.

Forty of the nations listed claim territorial limits of 12 nautical miles; 29 claim 3 miles. The 40 include Mainland China and the USSR. Nations adhering to the 3-mile limit include Canada, Republic of China (Taiwan), France, Japan, the U.K., and the U.S. (Tradition has it that 3 miles was the limit of early cannon.)

At least 8 nations claim a 200-mile territorial sea and/or exclusive fishing zone: Argentina, Chile, Ecuador, El Salvador, Nicaragua, Panama, Peru, and Uruguay*. Guinea's territorial limits extend 130 miles.

Fourteen, including Israel, Italy, South Africa, and Spain, maintain 6-mile territorial limits. Others vary from 4 miles for Finland, Norway, and Sweden to 10 for Albania and Yugoslavia.

Nearly 30 nations claim exclusive contiguous fishing zones 12 miles from the coast. Canada, France, the U.K., and the U.S. among others. At least 6 nations, including the U.S. and some Asian countries, maintain fishery conservation zones outside territorial and/or exclusive fishing waters.

Most nations assert exclusive claims over exploitation of Continental Shelf resources down to 200 meters. Many are parties to the Convention on the Continental Shelf.

The study notes that the 1964 Convention on the Territorial Sea and the Contiguous Zone sets no limits on the breadth of the territorial sea and may imply it should not exceed 12 miles.

*Brazil has joined group.--Ed.

INTERNATIONAL CONTROLS

"Comparative Study of Laws and Regulations Governing the International Traffic in Live Fish and Fish Eggs," by R. B. Zenny, EIFAC Technical Paper No. 10, European Inland Fisheries Advisory Commission, FAO Legislation Branch, FAO, via delle Terme di Caracalla, Rome, Italy.

International health standards are rigid for humans and livestock. They are notoriously lax for live fish and fish eggs shipped to foreign countries. Most fish diseases and infections are harmless to humans--yet they can cross frontiers to decimate entire fish populations in ponds, culture stations, lakes, rivers, and streams. The problem has been acute in some European and North American countries where many fish deaths have been attributed to imports of infected or diseased fish and eggs.

This is a report on the growing international exchange of live fish and eggs for culture (principally salmon and trout). Based on reports received from 86 nations, it reviews national legislation on live fish and egg trade, and finds most inadequate. Thirty-eight countries reported no control; most others had inadequate or poorly enforced legislation; only 10 appeared to have effective regulations.

"National legislation and policies, where they exist, are fashioned with little regard to the standards and practices in other countries," Zenny writes. Moreover, "effective control may be exercised over internal traffic, but not over imports or exports; over internal traffic and imports, but not over exports; or over imports only. The relevant legislation may exist on the statute books and may either not be implemented or only partly so."

Warning that fish diseases know no frontiers, and citing ever-increasing trade in live

fish and eggs, the study urges greater international collaboration on the establishment of a "uniform system of health control."

COD

"Géo-Économie de la Morue (Geo-Economics of Cod-Fisheries), edited by Jean Malaurie, Ecole Pratique des Hautes Etudes, Paris, published by Mouton & Co., P. O. Box 1132, The Hague, Netherlands. Price 65 Francs, 42 Dutch Guilders.

This is a compilation of papers presented at the first International Congress of the North Atlantic Cod Industry. The 25 papers cover production and processing, fishing methods, economics of fishing and production, biology, preservation and freezing, marketing, and recommendations for future action.

LOBSTER

"Lobster Storage," by H. J. Thomas, 55 pp., illus. Order from Sales Section, British Information Services, 845 Third Ave., New York, N.Y. 10022, 90¢.

Long-term storage--keeping lobster for several months--permits operators to take advantage of the high winter prices, and evens supplies in the process. It also enables the operator to sell on a good market rather than a glutted one. Short- and medium-term storage can increase profits by decreasing deaths in transit, and improving condition at market time.

This pamphlet is concerned mainly with medium- and long-term storage. It discusses methods used in Britain and abroad, and describes siting and construction; water conditions; handling; pests and diseases; welled boats; floating boxes and cages; pools and lobster ponds; refrigerated storage; and marketing.

AQUACULTURE

"Aquaculture: The New Shrimp Crop," Sea Grant Information Leaflet No. 1, Feb. 1970, U. of Miami, 10 Rickenbacker Causeway, Miami, Fla. 33149.

Interest in the commercial culture of marine and estuarine animals has been heightened by increasing need for more protein food--and by growing knowledge of the life histories of some animals that seem capable of being cultured.

Some schemes for producing marine resources by culture are considered impractical:

1. "It is very unlikely, for example, that aquatic farms will be set up in North America to grow marine plants for food. . . Although some seaweed are edible, they are relatively nonnutritious." And more important, there now is no food market for them.
2. "It seems unlikely that we can establish extensive marine fish farms in deep water because of the great practical and legal difficulties of creating and controlling large enclosures in these areas. Sea farms will, therefore, only be feasible in shallow water regions."
3. "At least in the beginning stages of marine aquaculture, only animals of market value can be raised profitably."

The possibilities of the commercial culture of crustaceans seem greater than those of other seafood. The U.S. demand for shrimp seems incapable of being satisfied. Demand in several other countries is growing too. Because of this, shrimp prices have reached high levels. "Consistently high market value encourages the hope that profitable culture operations may be possible."

There is a long history of attempts throughout the world to raise several species of shrimp: in India, Malaysia, Pakistan, Singapore, Vietnam, Cambodia, and Japan. Several of these are described.

At the University of Miami, marine aquaculture experiments have been launched with the pink shrimp, Penaeus duorarum. The procedures, as elsewhere in the U.S., "are similar to those of the Japanese and attempt to control the whole life history."

THE FOLLOWING ARTICLES ARE IN 'FISHERY BULLETIN,' VOL. 67, NO. 2. IT IS AVAILABLE FROM DIVISION OF PUBLICATIONS, BCF, 1801 N. MOORE ST., ARLINGTON, VA. 22209:

CHINOOK SALMON

"Egg-to-Migrant Survival of Spring Chinook Salmon ('Oncorhynchus tshawytscha') in the Yakima River, Washington," by Richard L. Major and James L. Mighell, pp. 347-359, illus.

Though the Columbia River runs are but a fraction of their former size, they are still a major producer of spring chinook salmon. In 1957, a study of egg-to-migrant survival of a population of spring chinook was begun on the Yakima River--a Columbia tributary. This paper summarizes the study from 1957 to 1963.

The Yakima was chosen because a trap in a diversion canal at Prosser, Wash., on the lower river, provided an unique opportunity to sample seaward migration.

Spring chinook spawning both in tributaries of the Yakima and in its upper stretch migrate in their second year. Comparison of the number of migrants with the number of eggs deposited by female spawners yielded an estimate of survival to the seaward migrant stage.

"Contribution of Columbia River Hatcheries to Harvest of Fall Chinook Salmon ('Oncorhynchus tshawytscha')," by D.D. Worlund, R.J. Wahle, and P.D. Zimmer, pp. 361-391, illus.

There are over 15 salmon-producing hatcheries on the lower 180 miles of the Columbia River. They were built primarily to offset the loss of natural spawning and rearing areas for salmon and steelhead caused by water-development projects. Releases of fall chinook have varied from fewer than 10 million fish from 6 hatcheries in 1949, to about 56 million from 14 hatcheries in 1966.

This article describes an experiment with fall chinook from 12 hatcheries. They were marked in 4 consecutive years to estimate their contribution to the sport and commercial fisheries. It estimates returns, catch, value and cost-benefit ratios.

ESTUARINE DESTRUCTION

"Some Effects of Hydraulic Dredging and Coastal Development in Boca Ciega Bay, Florida," by John L. Taylor and Carl H. Saloman, pp. 213-241, illus.

Hydraulic dredging has been an accepted means of creating premium-value waterfront real estate in Florida since 1920. Since 1950, it has become a serious threat. Bay filling has been little regulated and, in most cases, estuarine biological and recreational resources have been disregarded.

Boca Ciega Bay is a part of Tampa Bay. Coastal development and progressively deteriorating water quality have affected both its plant and animal production adversely. This report describes some of the biological and physical changes that have followed alteration. It also compares estuarine conditions in dredged areas with relatively undisturbed areas.

Urging against further destruction by development, the authors note: "In Florida, and other States bordering the Gulf of Mexico, dredging and other forms of estuarine destruction damage fisheries, because most of the species taken in sport and commercial fisheries live in estuarines during part or all of their life cycle." They add: "Perhaps, the most timely argument against further destruction of estuarine habitats is the present and potential value of these areas for production of food."

The report also cites economic losses from filling and dredging:

"Fishery production alone in Tampa Bay estuary has an annual value of about $300/acre. In addition, these waters are used by public utilities, industry, and commerce and serve recreational requirements of nearly a million residents and 1½ million annual vacationers. Hence, total worth of each water acre in the estuary can be conservatively estimated at $400/acre. At this rate, the 3,500 acres covered by bayfills in Boca Ciega Bay represent an annual loss of about $1.40 million, which if capitalized at 6% would total a natural investment of $23.3 million. This accounting is not complete because the undesirable aspects of coastal development extend well beyond bulkheads and outfalls."

PESTICIDES

"Effects of Pesticides on Embryonic Development of Clams and Oysters and on Survival and Growth of the Larvae," by J.C. Davis and H. Hidu, pp. 393-404.

To control certain insects and undesirable plants, highly persistent pesticides have been used extensively in recent years--not only on agricultural lands, but on recreational areas, lakes, streams, and marshes. This has made evaluation of their effects on fish and wildlife imperative. Attaining control of undesirable species, while doing the least possible harm to desirable ones, requires extensive knowledge of how each pesticide affects each species.

This is a summary of data obtained at BCF's Milford (Conn.) Biological Laboratory on the effects of various pesticides on development of fertilized eggs of hard clams and American oysters, and on survival and growth of the larvae. It also describes study methods, and cites the need for further work.

SHELLFISH PREDATORS

"Changes in Abundance of the Green Crab (Carcinus maenas, L.) in Relation to Recent Temperature Changes," by Walter R. Welch, pp. 337-345, illus.

The green crab catch is of minor commercial importance. It is fished only as bait for sport fishermen. Major interest in the species arises from the fact that it is a significant predator of the commercially valuable soft-shell clam, Mya arenaria. Mass mortalities of green crabs coincide with periods of severe cold. The commercial catch of soft-shell clams increases markedly when the crabs decline.

This paper documents the changes in abundance of green crab from its peak in the mid-1950s, relating changes to concurrent changes in temperature.

/————/

"The Feeding Habits of the Green Crab, Carcinus maenas, L.," by John W. Ropes, pp. 183-203.

This is a study of the feeding habits of green crabs. It contains observations on the relation of feeding behavior to environment and available food.

MARINE RESOURCES & COURSES

"Oceanography in Florida 1970," Florida Department of Commerce, 262 pp., $1. Available from E. Earl Donaldson, Executive Director, the Florida Council of 100, P.O. Box 2192, 601 Twiggs Street, Tampa, Fla. 33601.

A comprehensive analysis of marine science, technology, and oceanographic activities. It includes a complete description of all Florida's sea-related organizations, facilities, and natural resources.

/————/

"Directory of Academic Marine Sciences Programs in New England," New England Marine Resources Information Program, University of Rhode Island, 51 pp. Free copies available from NEMRIP, Narragansett Bay Campus, URI, Narragansett, R.I. 02882.

The directory lists the courses in marine sciences offered by 41 institutions of higher learning in the six-state New England region. It includes those of the Woods Hole Oceanographic Institution.

--Barbara Lundy

INTERNATIONAL

FORECAST SLIGHT RISE IN MARINE-OIL OUTPUT FOR 1970

Although fish-oil production declined in 1969, world output of marine oils is forecast to increase slightly in 1970. However, it is expected to be somewhat below 1968's record. Baleen-whale oil may rise slightly; no appreciable change in sperm-whale output is anticipated.

Baleen Oil

After a long downtrend starting in 1962, baleen-whale oil production is expected to increase. This estimate is based on a fairly large Norwegian Antarctic catch. Production outside the Antarctic is not expected to change significantly.

Quotas

The 1969/70 Antarctic pelagic whaling countries (Japan, Norway, USSR) agreed to a reduced global quota of 2,700 blue-whale units (BWU)--roughly equivalent to 56,000 tons of oil. The 1968/69 quota was 3,200 BWU. The catch was only 2,469 BWU, with an estimated output of about 51,000 tons of oil. Japan and the USSR both filled their 1968/69 quotas. Norway (quota of 731 BWU) did not participate; her quota later was cut to 231 BWU--roughly equivalent to 5,000 tons of oil. Reportedly, Norway plans to participate in the 1970 expedition.

Forecast Assumptions

The 1970 forecast assumes: 1) fulfillment of the 2,700 BWU global quota; 2) an oil yield approximating 1969's 20.8 tons per BWU; and 3) continuance of output outside the Antarctic at the 1969 level.

Sperm-Whale Oil

Sperm-whale oil production is not controlled under the Antarctic quota agreement. It is not expected to change significantly. This production has continued to be relatively stable, slightly above volume produced during 1962-66. The biggest producer, the Soviet Union, has expanded output substantially in recent years, while output by small producers has been sharply reduced. The North Pacific output has expanded; Antarctic pelagic output has remained about the same; output from shore stations outside the Antarctic has declined.

Fish-Oil Prediction Difficult

Forecasting world output of fish body and liver oils a year in advance is a precarious task. Among the uncertainties are: probable catches by major countries; possible changes in catch restrictions in countries like Peru; closed seasons; possible strikes; probable oil yields; and possible effects of higher prices tending to stimulate fishing activity.

Forecast

Peruvian fish-oil output in 1969/70 season is not expected to change appreciably, despite a probable decline in the catch limit. The Peruvian Marine Institute has recommended an anchovy catch limit of 9.4 million short tons, compared to 10.9 million tons in 1968/69. The expected oil output is based on an anticipated recovery in oil extraction rate. Some recovery in output from last year's reduced volumes is expected in Norway and Iceland. Possible small increases by Canada, the USSR, and Japan may lead to some overall increase in 1970 world fish-oil production. ('World Agriculture Production and Trade,' Jan. 1970.)

WORLD FISHERY TRADE INCREASED IN 1968

Both quantity and value of world trade in fishery commodities increased in 1968. The share of fish used for fish meal reached a new high. This information comes from FAO's recently released 'Yearbook of Fishery Statistics (Commodities).' The volume lists 1968 commercial and production figures for 150 countries, excluding Mainland China.

Quantity & Value

The value of trade in fish and fish products increased to about US$2,560 million from about $2,400 million in 1966 and 1967. The rise was due largely to improved fish-meal

prices. Volume increased from 6,400,000 metric tons in 1966, and 7,103,000 tons in 1967, to 7,841,000 tons in 1968. Fish meal accounted for 3,591,000 tons and $456 million.

Consumption

The Yearbook also shows consumption of the 64,000,000-metric-ton 1968 world catch of marine and inland-water fish. Almost two-thirds (40,200,000 tons) was frozen, cured, canned, or eaten fresh; 22,800,000 tons, or 35.6%, went into fish meal for animal feed. In 1958, only 13% of the total fish catch was used for fish meal.

HALIBUT SURVEYED IN SOUTHEASTERN BERING SEA

The trawler 'St. Michael' left Bellingham, Washington, Feb. 17, 1970, on a 65-day halibut survey in the southeastern Bering Sea. Sailing under charter to the International Pacific Halibut Commission (IPHC), she is evaluating the incidental catches of halibut in the food-fish catches of foreign trawl fleets. Small, and probably large, halibut are particularly vulnerable to such fishing at this season. The vessel's crew also is doing extensive tagging.

The Commission is responsible to Canada and the U.S. for maintaining halibut stocks at maximum productivity. (IPHC, Feb. 16.)

ATLANTIC SALMON HIGH-SEAS FISHERY INCREASED IN 1969

The 1969 Atlantic salmon catch off Greenland was about 2,210 metric tons, 39% over the previous high in 1967. Fish were prevalent over a wide area of Davis Strait and a substantial fleet took advantage of the situation. Fleets from Denmark, Norway, and the Faroes notably expanded the offshore drift-net fishery. They caught 1,280 tons compared to 544 in 1968. Greenland's catch, up from near-failure in 1968, was still 25% less than her 1967 and 1966 inshore catches; 1969 was the first time Greenland had participated in the offshore fishery.

Larger Fleets & Catches

Danish fishermen made the largest gains. With 18 vessels, they tripled their 1968 catch, when they had only 7. Norwegian and Faroese vessels more than doubled, but catches rose only about two-thirds.

Catch Off Norway

Danish, Swedish, and Norwegian vessels are rapidly expanding the high-seas fishery for Atlantic salmon off Norway. The fishery is some 12 to 200 miles offshore, northward from Bergen to Finmark. Norway is seriously concerned that her valuable salmon stocks are being depleted. The 1969 catch probably will be over 800 metric tons, more than double 1968's. A sharp increase is reported in participating Norwegian and Danish vessels. Norway has protested the salmon's "ruthless exploitation" by Danish vessels. Five German vessels participated for the first time.

Norwegian Restrictions

Norway severely curtailed her inshore and river fisheries. Longline fishing has been forbidden for some time in Norwegian fishing limits. However, drift gill nets are permitted up to the inshore base lines of her territorial sea. Danish and Swedish fishermen initiated longlining beyond the fishing limits, and Norwegians recently entered the fishery with great vigor. Charges that offshore fisheries are destroying the benefits of inshore conservation are being discussed violently.

Reports from Norway indicate that if developments in the salmon fishery continue to be favorable, as many as 300 vessels might participate in the offshore fishery.

Baltic Fishing

Atlantic salmon are exploited extensively in the practically land-locked, brackish-water Baltic Sea. The salmon exchange between the Baltic, the North Sea, and the Atlantic Ocean is relatively minor. Total Baltic high-seas catch in recent years has been 2,000-2,500 tons. More than half is taken by Danish fishermen; Sweden takes 20%, and West Germany 10%.

Denmark catches almost equal quantities of salmon in the Baltic and off Greenland. In the 1968/69 season (July-June), the catch totaled 1,465 metric tons, 13% below the previous record but still near 1966/67 (and earlier) catch levels. Up to 1963/64, annual catches were mostly near, or below, 1,000 tons. (Reg. Fish. Attaché, Copenhagen, Feb. 19.)

WORLD'S FIRST FLOATING FPC FACTORY IS OPERATING

Last month, Astra Nutrition began operating the world's first floating factory to produce high-quality fish protein concentrate (FPC). The firm is part of the Astra group, Sweden's largest pharmaceutical house.

Harry Wendeus, managing director of Astra Nutrition, said recently: "The world's first continuous processing plant for producing human grade fish protein concentrate went into production late in 1969 at Bua, a fishing community on the West Coast of Sweden. Its output will be supplemented when a 25,000-ton modernized and fully-equipped 'floating factory', upon which more than $7,000,000 has been spent, goes into operation in international waters. This ship will be attended by 11 fishing boats that will provide the mother ship with a constant supply of fresh fish." He noted the importance of a fresh fish supply to insure quality control. Astra Nutrition has applied for process patents in 40 countries.

Fig. 1 - Motor/Ship 'Astra', a 25,000-ton, $7-million "floating factory" operated by Astra Nutrition of Sweden. It will process high-grade fish protein concentrate (FPC) from daily catch of fishing boats.

The principle used in the Astra process is extraction of water and oil from the fish with isopropyl alcohol. This is the basic method for making wholesome and acceptable fish protein concentrate that the Bureau of Commercial Fisheries developed and demonstrated to the U.S. Food and Drug Administration--enabling FPC to be used as a food in the United States.

The protein will be used as an ingredient in products for developing countries.

Obstacles Overcome

Astra developed a laboratory method of producing defatted fish protein concentrate in 1957, producing 20 grams during the first year

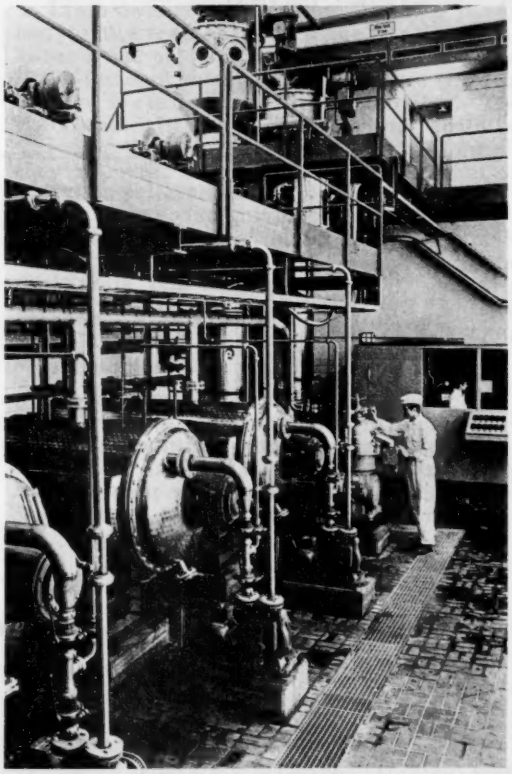
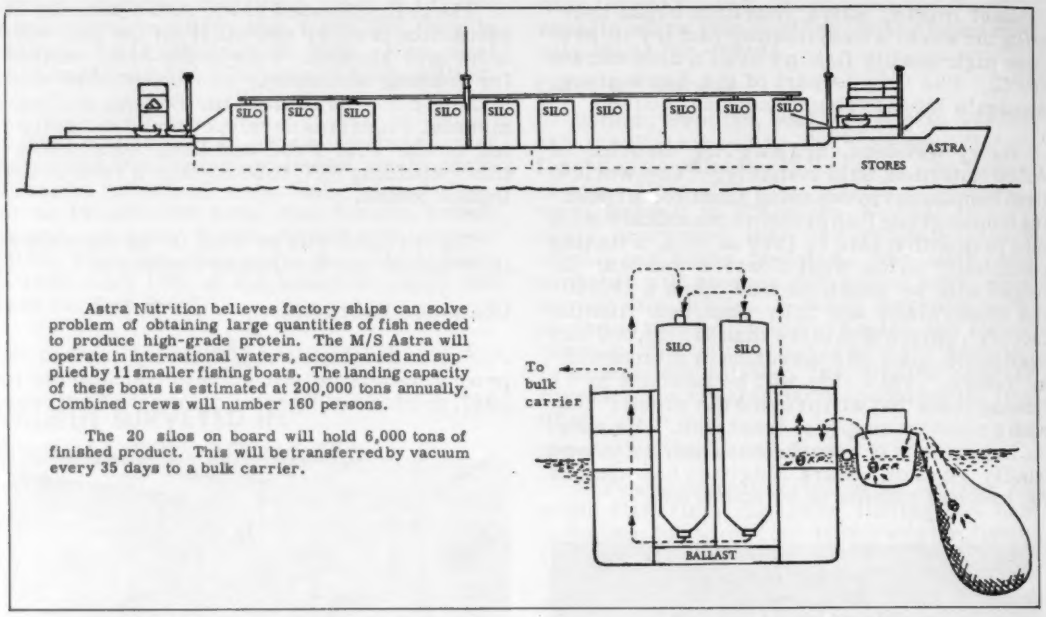


Fig. 2 - Astra's FPC processing method first removes fat and bones. The stainless steel equipment readies powdered concentrate for storage in 20 large silos that extend above and below decks.



Astra Nutrition believes factory ships can solve problem of obtaining large quantities of fish needed to produce high-grade protein. The M/S Astra will operate in international waters, accompanied and supplied by 11 smaller fishing boats. The landing capacity of these boats is estimated at 200,000 tons annually. Combined crews will number 160 persons.

The 20 silos on board will hold 6,000 tons of finished product. This will be transferred by vacuum every 35 days to a bulk carrier.

in 4 days. In 1960, the difficulties of transferring the manufacturing process from laboratory to plant scale "seemed unsurmountable," Wendeus said. "By 1961 we had to re-evaluate the entire method and start over again." By 1963, Swedish authorities approved FPC as a foodstuff. A continuous, rather than batch, process was developed.

Wendeus said product compares favorably with animal protein from other sources. It is a "complete animal protein with a high nutritional content, about 93% protein, with a good amino acid balance. It contains phosphorous, calcium and minerals in proper proportion."

All protein molecules combine smaller chemicals called amino acids. Generally, proteins from animal sources are of higher quality than those from vegetables. Of 22 amino acids that have been isolated, eight are regarded essential in the diet.

Astra Joins National Biscuit

In Jan. 1970, Astra and National Biscuit Co. of New York formed joint venture--Nabisco-Astra Nutrition Development Corp.--to research and develop sources of essential low-cost protein for use in human food products. The new company will direct its efforts toward reducing the serious protein deficiency in many developing nations.

FAO MASTERFISHERMAN FOR DEVELOPING WORLD

An FAO feature written by Gabriel De Sabatino tells the story of Captain Pierre A. Lusyne, a 60-year-old Belgian who went to sea in sailing ships at 14 and who, as an FAO Masterfisherman, has been sharing his experience with apprentice fishermen in developing countries for the past 15 years.

Lusyne, a native of Ostend, has organized and directed some of the fishing training centers FAO has established around the world under the United Nations Development Programme.

FAO believes the centers are essential to train crewmen properly at a time when fishing vessels have computers and other complex equipment for finding and catching fish. Highly skilled hands are required. Education and training are so vital to fishery development and to food production that the matters will be discussed at the Second World Food Congress FAO is convening at The Hague, Netherlands, June 16 to 30.

His Proudest Achievement

Lusyne's proudest achievement is the Deep Sea Fishing Training Centre he organized for the Republic of Korea (S. Korea) to provide trained crewmen for the country's growing fishing fleet. The center was established in Pusan in 1965 under a 5-year $2,800,000 FAO project financed jointly by UNDP and Korean Government. The center was so successful that Lusyne turned its direction over to the Koreans on schedule in 1969. "They are operating it entirely on their own with just occasional help from us," he said in Rome. "It's all their show now."

Lusyne, who speaks no Korean, had to start from scratch, as he did with the other projects. In less than a year after the project was negotiated, the center was operating. He noted: "We started out with 50 trainees out of 300 applicants and only five instructors, all of whom I had to brief myself. Now there is a much larger staff and the centre graduates about 150 apprentice fishermen a year."

The Center

The course lasts 18 months: 10 months' shore training, $7\frac{1}{2}$ months at sea aboard the center's two training ships. Then there are 15 days of summing up and examination.

The trainees, who include non-Korean nationals, are selected carefully and live at the center. The center is well equipped with workshops and demonstration rooms. The trainees receive blue uniforms, red caps, and a small allowance. They make their own tools and gear for the fishing trials aboard the ships. The tuna they catch is sold to a cannery in Samoa, and the money helps pay for the school.

Discipline and cooperation are excellent, reports Lusyne, who runs his schools with near-naval discipline. "The trainees are encouraged to keep busy even in their spare moments and physical exercise is a daily 'must.' It is good for morale as well as for physical fitness. It instils a good team spirit and a sense of participation among the men."

In his 5 years at the school, Lusyne never had to put a trainee in his place. "Only once, aboard one of the training vessels, we had a little incident when the trainees got tired of being at sea and wanted to return to port. The FAO Masterfisherman told them he would be fired if he did so and retired to his cabin until they reported ready for work. The matter ended there and then."

Survived Dunkirk

Lusyne became an instructor after a World War II eye injury disqualified him for sea duty. He had taken part in the evacuation at Dunkirk in 1940 and was almost killed when his ship was rammed accidentally in the dark by a destroyer and sank with 300 troops. He says his survival was a pure miracle.

In 1945, he organized a fishing-training school in Ostend as part of Belgium's reconstruction efforts. In 1955, he joined FAO and was sent to India. There, working under a Technical Assistance project, he organized 4 training centers, which later expanded to 12. Later, he set up schools in New Caledonia in the western Pacific, in Suez, U.A.R., and in Vang Tau, Vietnam. He also served as a training adviser in Pakistan. In 1964, he was sent to Korea to establish the deep-sea training center.

The Sea at $13\frac{1}{2}$

The Belgian sea veteran has excellent credentials as a seagoing schoolmaster. His father ran a fleet of fishing smacks that sailed

by wind power alone. He gave Pierre his first taste of the sea when he was 13½. The elder Lusyne, an old-school captain, rejected engines--and lost out to motorized competitors. "He had put all his faith in sails," Lusyne says nostalgically.

Now Lusyne is preparing for yet another assignment, perhaps South America.

1970 YELLOWFIN TUNA SEASON IN EASTERN TROPICAL PACIFIC ENDS

The season for harvesting yellowfin tuna in the eastern Tropical Pacific Ocean ended at 12:01 a.m., local time, on March 23, 1970.

On March 18, the Director of Investigations, Inter-American Tropical Tuna Commission, recommended the closure data to all nations with vessels in the regulatory area. It was done to assure that the established catch limit of 120,000 short tons for 1970 would not be exceeded.

Nearly 68,000 Short Tons

The catch reported by the Commission, Jan. 1-Mar. 23, 1970, was 67,913 short tons. This is 14,383 tons, or 27%, greater than the 53,530 tons of the comparable period in 1969.

JAPANESE SOUND OUT MEXICANS ON JOINT FISHING IN MEXICO

The Japanese Nichiro Fishing Co. is sounding out Mexican fishery interests on the proposed joint fishing venture to promote Mexico's fisheries. Although the details are unknown, the proposed plan calls for Japanese-U.S.-Mexican fishing company in Ensenada to produce tuna, shrimp, and fish meal. Also planned is the sale of fish-meal plants.

U.S. Firm Would Sell Catch

The U.S. partners reportedly would handle all sales of fish caught. The Japanese firm is seeking a loan from its government on grounds that the venture would extend Japanese technology to Mexico. Japan has concluded a fishery agreement with Mexico. If the proposal takes shape, the Japanese firm plans to send a survey team to Mexico around May. ('Suisan Keizai Shimbun,' Mar. 6.)

JAPAN AND MAURITANIA REACH FISHERY AGREEMENT

On Feb. 19, 1970, Japan and Mauritania signed an agreement permitting Japanese trawlers to fish inside Mauritania's 12-mile exclusive fishery zone. The pact became effective April 10 and will run one year. Then it may be extended by mutual agreement.

What Agreement Provides

The agreement provides that: (1) 24 large Japanese trawlers will be permitted to enter Mauritania's 12-mile exclusive fishery zone from April 10; also 5 small vessels (30-50 gross tons) will be allowed inside the 3-mile territorial water zone to train 1-3 Mauritanian fishermen aboard those vessels; (2) fish catches by the 5 small vessels will be delivered to shore-based cold storages for sale at prices determined by committee of Japanese and Mauritanians; and (4) fishing fee will be assessed as 'cooperation fee'; it will includes charges for use of port and other fishing-connected facilities. The amount of assessment reported was about US$27.80 per gross ton of vessel, agreed to in earlier talks. ('Suisan Tsushin,' Feb. 26.)

CANADA

NEWFOUNDLAND'S 1969 LANDINGS TOPPED BILLION LBS. FIRST TIME

Newfoundland's sea fish landings in 1969 exceeded one billion pounds for the first time on record, reported the Canadian Dept. of Fisheries & Forestry. It was an increase of 6.7% over 1968's 951 million pounds. The gross landed value of C$28.2 million was up 1.1% from 1968's record C$27.9 million. The lower relative increase in landed value reflected a further increase in herring landings--as average groundfish and shellfish prices remained stable.

Groundfish Down

Groundfish landings were 610 million pounds, down 1.8% from 1968. Cod landings, which fell 11.3% to 329 million pounds, accounting for most of decrease in groundfish catch. A poor Labrador fishery and decreased catches in northern Labrador caused the decline.

Flounder landings rose to 163 million pounds from 136 million pounds in 1968. The ocean perch (redfish) catch declined slightly from 1968's 76 million pounds. Landings of Greenland turbot rose 27% from 1968's 30 million pounds because fishing increased on new grounds. Other groundfish amounted to 11 million pounds, compared to 1968's 8 million pounds.

Offshore Trawler Landings

Groundfish landings by Newfoundland's offshore trawler fleet were 276 million pounds, 2.6% over 1968. This fleet accounted for 45.3% of total groundfish landings, 20% of cod landings, 87% of flounder and ocean perch.

Pelagic & Estuarial Species

Landings of pelagic and estuarial species were 401 million pounds, up 22.6% from 1968. Herring landings of 390 million pounds showed another substantial increase. Reduction plants continued to operate at full capacity during herring season; there was increased demand by producers of pickled products.

Salmon landings declined slightly from 1968's 3.2 million pounds. Capelin landings of 7.6 million pounds were virtually the same.

Shellfish Climbed 11.3%

Landings of shellfish increased 11.3% from 1968's 4.4 million pounds due to higher catches of scallops and crabs. The lobster catch fell 4.9% from 1968's 4 million pounds; however, higher prices offset volume decline, and value remained C$2.4 million.

The scallop fishery yielded 275,000 pounds, more than double 1968's catch. Crab landings were 730,000 pounds; 190,000 pounds in 1968. Squid landings were insignificant.

Fewer Fishermen

The number of commercial fishermen fell from 19,355 in 1968 to 18,150. Of these, 3,430 fished 10 months or more, 8,500 5 to 10 months, and 6,220 less than 5 months.

There were 16,700 inshore fishermen in 1969, 18,041 in 1968. There were substantially fewer Labrador fishermen.

The stationers and floaters who did not go to Labrador apparently remained out of the fishery from the island as well. The offshore fleet provided jobs for 1,450 men; in 1968, 1,314.

Fewer Motor Boats

With fewer fishermen and the shift to small longliners continuing, the number of motor boats decreased by 1,000 to 9,500. The number of row boats also declined to 3,900 from 4,440 in 1968. The fleet of small longliners (under 25 gross tons) increased by 44 to 375 at year's end. Most of this increase occurred in the Fogo Island-Twillingate and Port au Choix areas.

Variety of Vessels

Some large longliners and jackboats (over 25 gross tons) remained in use, with new vessels replacing those not used. At year's end, there were 67 otter trawlers in operation, compared with 60 a year earlier. Also, five small inshore draggers operated, two fewer than in 1968.

* * *

CANADA (Contd.):

BRITISH COLUMBIA'S FISHING INDUSTRY VIEWS THE 1970s

The Fisheries Association of British Columbia, in its monthly "Facts on Fish" (Jan. 1970), listed problems it would like to see resolved in the 1970s:

(1) Protection of coastal fish stocks from foreign fleets. This refers primarily to U.S. fishermen. (2) Protection from huge Japanese and Soviet trawl fleets. (3) Exclusive jurisdiction by coastal state over its Continental Shelf; control of fisheries resources made a part of international law. (4) Protection of halibut nursery stocks from Soviet and Japanese trawl fisheries. (5) Control of pollution. (6) Increase of salmon resources and more consistent production. (7) Better use of dogfish. (8) Better pay for fishermen, and (9) Greater consumption of fish.

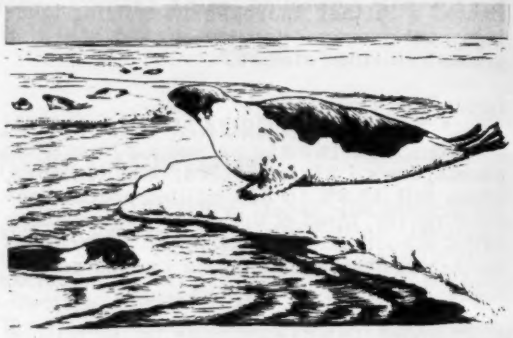
Difficult Decade

The Jan. 1970 "Western Fisheries," a Vancouver monthly trade magazine, states that the 1970s will bring a decade of hard negotiation between Canada and the U.S. The article concedes that the fisheries of the two countries are so interwoven that compromise and full cooperation in conserving and exploiting the stocks are primary requirements. However, two views are elaborated that seem to indicate that either Canada should go it alone--or renegotiate a treaty with a greater percentage of increase in fisheries going to Canadian fishermen.

* * *

EXTENDS BAN ON HUNTING BABY SEALS

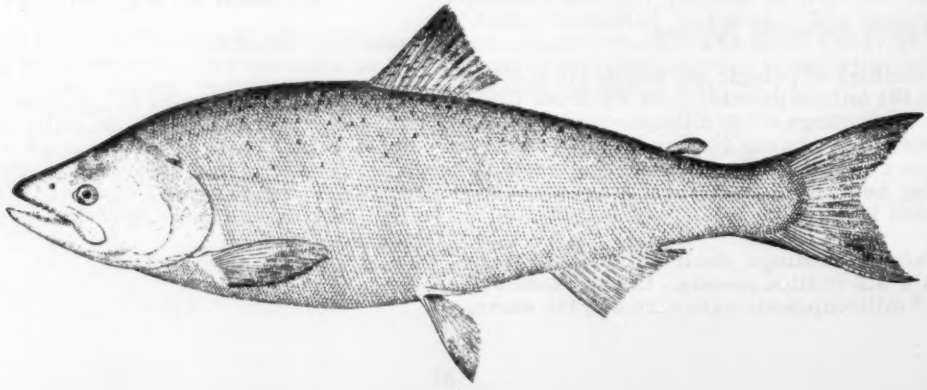
The ban on killing baby "whitecoat" seals, announced in October 1969, has been extended to the North Atlantic. Norway is honoring the ban. The March 22 opening date for the hunt, both in the Gulf of St. Lawrence and off Labrador's east coast, should prevent the taking of baby seals. (Canadian Dept. of Fisheries and Forestry, Jan. 30.)



* * *

APPROVES LEGISLATION FOR SALT FISH CORPORATION

The House of Commons' Fisheries and Forestry Committee has approved authorizing legislation for a Salt Fish Corporation. The corporation would regulate interprovincial and export trade in salt fish. It would be provided with C$10 million to buy and hold fish in advance of sales. The money also could be used for loans to fishermen.



EUROPE

USSR

PLAN TO EXPAND FISH FARMING

The Soviets are speculating on the possibility of farming algae (Ahnfeltia, Phyllophora, Furcellaria, Laminaria, and Chlorella) for human and animal food. Scuba divers would "farm" the sea algae; fresh-water species would be cultured at animal-breeding farms. Soviet scientists claim 20% of fishery resources of world's oceans must be left intact to ensure safe replacement of stocks. This "danger limit" is being approached rapidly. It is why need arises for effective "management." Now, only half world's catch is used for food; the other half is processed into fish meal, fertilizers, oils, etc.

The Soviet Continental Shelf covers 6.6 million square kilometers--nearly half in waters less than 50 meters deep. This area offers greatest potential for resource management or fish farming. ('Sots. Ind.,' Nov. 23, 1969.)

V. P. Zaitsev, a leading scientist, reported experimental Ahnfeltia farming in Soviet Far East and on Solovetskie Islands in White Sea; this showed that algae can be improved by hybridizing and fertilization. He claims Chlorella has as much vitamin C as lemons and 4 times as much protein as wheat. Many tasty dishes can be prepared from sea kale, which also has medicinal value.

Black Sea

Experimental oyster and mussel (Mytilus) farms on the Black Sea become economically self-sufficient in 3 years, according to Zaitsev. Fish can be "pastured" in lagoons saturated with nutrients. ('Pravda,' Oct. 22, 1969.)

Far East

In the Far East, a special 80-vessel fleet is "harvesting seaweeds and mollusks" for several processing plants. The Far East is their main harvesting and processing base for Pacific algae, squid, octopus, sea cucumbers, crustaceans, and shells. Catches of marine products other than fish reach tens of thousands of metric tons.

Barents Sea

The first Soviet commercial farm to operate on the Barents Sea will experiment with breeding flounder, cod, haddock, and herring. It will be equipped with hatcheries, aquaria, and forage grounds for fish. If the experiment is successful, the Soviets plan a "network of underwater 'farms' with a sizable yield." (TASS, Dec. 2, 13, 1969.)

* * *

SCIENTISTS OBSERVE FISH WITH UNDERWATER TV

In 1969, scientists of the Kamchatka Branch of the Pacific Fisheries and Oceanography Research Institute (TINRO) used underwater TV cameras to observe salmon migration into Kuril Lake (Soviet Far East). They determined with "absolute accuracy" the number of migrating salmon. The new observation method is claimed to have great importance for determining fishery stocks and directing fishing operations. Research continues.

Detect Salmon 2 Km. Away

The scientists are also experimenting with a new hydroacoustic detection device aboard vessels on the high seas. The device has located salmon accumulations 2 kilometers away, and determined their number and migration path.

The expanded 1970 test program with the new device is aimed at making it suitable for detection of smaller fish like herring and perch.

* * *

UNDERWATER FILM SHOWS FISH CAN 'LEARN'

An underwater film on trawls and fish behavior shows that fish can "learn" how to avoid or escape nets, and hide behind rocks and between bottom rises where trawls cannot get them.

Since this ability will make conventional fishing gradually less efficient, scientists have suggested the use of artificial schooling

USSR (Contd.):

techniques with electric light, ultrasounds, feed concentrations, and even aromatic substances.

The photographers were 2 scientists of the Soviet Atlantic Fisheries and Oceanography Research Institute. ('Sotsialisticheskaia Industria,' Nov. 23, 1969.)

* * *

SEIZED 39 JAPANESE FISHING VESSELS IN 1969

In 1969, the Soviet Union seized and detained 39 Japanese fishing vessels and 363 fishermen. By year's end, 33 fishermen were still held.

The Soviets captured 40 Japanese vessels in 1968. From the end of World War II to December 1969, the Soviets seized 1,314 Japanese fishing vessels and 11,126 fishermen.

Japan Plans Aid

Japan plans to develop relief measures for owners and crewmen of the captured vessels; 7,488,000 yen (US$20,800) have been earmarked for that purpose in fiscal 1970 (April 1970-March 1971). ('Suisan Tsushin,' Feb. 2, and 'Nihon Suisan Shimbun,' Jan. 21.)

NORWAY

CANNED FISH EXPORTS FELL IN 1969

Although official Norwegian figures were available only through October 1969, it was predicted in January 1970 that 1969 canned fish exports would not match 1968 volume. This was attributed to inadequate supplies of raw material, particularly for the most important canned commodity, sild sardines. Stocks of several of the most popular packs were extremely short.

Kippers

Kipper exports fared even worse due to lack of raw material. For the past 2 years, exports have been less than half the volume of the late 1950s.

Herring Roe

Exports of soft herring roes dropped drastically as the winter herring fishery vanished.

Shrimp

Exports of peeled shrimp were only 3-4% of the volume of 10 years ago. The main reason is that the raw material has been used for other consumption and processing. Also, canned-shrimp production has developed tremendously in many other countries.

Brisling

Despite the canners' lack of raw materials for sild sardines and kippers, they were able to keep factories running fairly well due to good supplies of brisling. Brisling stocks were at normal levels. There were small stocks of several types of sild sardines. Kipper stocks were negligible and normally would have been completely exhausted, but small quantities were being held in reserve for old customers. ('Norwegian Canners Export Journal,' Jan. 1970.)

Exports (calculated in $\frac{1}{4}$ cases):

	Mid-Dec. 1967	Mid-Dec. 1968	Mid-Dec. 1969
Brisling	347,000	373,000	336,000
Sild	849,000	1,023,000	940,000
Kippers	254,000	182,000	197,000

* * *

HERRING FISHERY ON GEORGES BANK IS UNSUCCESSFUL

The factory vessel 'Gadus' returned to Norway after a 4-month fishing trip to Georges Bank and other areas of the American coast, where whe fished herring with a floating trawl. The results were below expectations.

The pack amounted to about 600 metric tons of herring fillets. Herring was considerably less abundant on Georges Bank. They arrived one month later than usual and were difficult to fish because they congregated in very shallow waters. Night fishing took place in 20 to 40 fathoms, and day fishing in deeper waters. In August, the fish were found in entirely uncustomary places.

The Fishing

Most herring were fished on Georges Bank toward northwest and northeast; some in the

NORWAY (Contd.):

Gulf of Maine. During the last leg, Gadus fished off Nova Scotia, where the herring were large and of high quality. During the end of October, the crew caught about 150 to 160 metric tons during one week. The herring were different from the species found on and near Georges Bank. Poor weather intensified toward season's end and retarded catch.

The bulk of the pack was delivered to Cuxhaven in Germany. (Reg. Fish. Attaché, Copenhagen, Feb. 19.)

* * *

SAITHE SALES TO EAST EUROPEAN MARKET WILL SET RECORD

Norwegian sales of deep-frozen saithe fillets to COMECON (Communist East European) countries will total a record 20,000 metric tons this year. The Soviet Union is expected to purchase most, 10,000 tons, after several years of declining purchases. This large purchase will not affect Soviet purchases from other areas, mainly Iceland and Britain.

Soviet Saithe Catch Drops

The Soviet catch of saithe decreased from 33,800 tons in 1966 to 11,900 tons in 1968; it is most likely reason for increased Soviet purchases abroad. Norway does not expect the increased sales to the Soviet Union to adversely affect sales to her more stable markets, such as Czechoslovakia and Hungary.

Wants Larger Saithe Market

Deliveries to the U.S., Western Europe, and other markets are based on cod, haddock, and other white fish, not saithe. Norway would like to change this. She considers saithe a delicacy and would like to expand its market. (Export Council of Norway, Mar. 1970.)

* * *

NEW WHALING FACTORYSHIP IS DELIVERED

A new factory whale catcher, 'Peder Huse,' has been delivered to Torodd Huse and Partners, Steinshamn, Norway.

She has been equipped with up-to-date machinery that will clean-cut vacuum-packed and frozen whale beef, freeze whale meat in blocks as raw material for sausage and fodder, and increase production of whale oil. Her loading capacity is 500 metric tons of whale meat and 250 tons of oil.

Packing & Production

Whale meat is stored in 2 cooling tanks aft. It is processed on 3 production lines consisting of conveyors, cutting tables, and freezers. The beef, clean-cut and packed by a special machine, is frozen and packed in cartons. The frozen blocks of sausage meat and fodder are glazed and packed in plastic bags. The whale oil is produced aft of the factory area.

Contracts Made

Contracts have been made to deliver whale meat to Japan, and fodder to England, after the 1969/70 Antarctic season ends. Norway returned to whaling for the 1969/70 season after a year's absence. ('Norwegian Fishing and Maritime News,' Vol. 4, 1969.)

* * *

WILL PURCHASE FLOATING HERRING-MEAL FACTORYSHIP

Norway may obtain her first herring-meal-and-oil factoryship. The 27,000-ton, US$8 million vessel will fish globally, aided by 10-20 purse seiners. NORGLOBAL A/S is backing the project.

NORGLOBAL

The cooperative NORGLOBAL has capital of about US$1 million; 53% is owned by north Norwegian interests. Factory and equipment is estimated at $3.5 million, and vessel purchase at $2 million. Total capital requirements amount to $7.4 million.

The vessel will require 20-25 men to work in its floating factory and 20-25-man crew. (Reg. Fish. Att., Copenhagen, Feb. 19.)

* * *

SHRIMP FACTORY SHIPPED TO KUWAIT

A complete shrimp factory has been shipped to Kuwait from the Norwegian engineering concern, Haahjem Mekaniske A/S of Vigra. The firm also is working on other orders for Kuwait.

NORWAY (Contd.):

The factory will be operated in connection with a fleet of shrimp trawlers, also built in Norway, which has been fishing with good results in the Persian Gulf for several years.

Previously, the Norwegian factory exported fish-processing plants and equipment for installation aboard factoryships. (Export Council of Norway, Feb. 1970.)

WEST GERMANY

HERRING FISHERY DEVELOPS OFF U.S. ATLANTIC COAST

The developing West German fishery for herring off the U.S. Atlantic coast was spurred by recent failures on European herring grounds. West German vessels began fishing the Georges Bank area to ensure adequate supplies for their domestic industry.

This fishery began in earnest in Aug. 1967 with the appearance of 5 freezer-trawlers. Vessels arrive in July and stay until Dec. The main months are Aug., Sept., and Oct., with up to 35 vessels fishing.

The Catches

The 1968 catch was about 38,000 metric tons, product weight--double 1967's. The 1969 catch was expected to be close to 90,000 tons (50,000 tons). Such quantities guarantee sufficient supplies.

Becoming More Important

For economic reasons, the bulk of herring from Georges and Banquereau Banks was landed and transshipped from St. Pierre et Miquelon on reefer ships to West Germany.

Production of frozen herring off the U.S. will become more important in West Germany's herring industry. Marketing of frozen herring rests exclusively with Seefrostvertrieg GmbH. This year's contract between the firm and German industry was arrived at quickly. It led to greater employment of the fleet on Georges Bank.

UNITED KINGDOM

FISH LEVY INCREASED & EXTENDED

The White Fish Authority's (WFA) general levy on fish was increased and extended on Feb. 15, 1970. Previously, WFA had collected a levy only on first-hand sales of white fish--sea fish, fresh or preserved, other than herring, salmon, and migratory trout. Now there are differential rates for landed or imported white-fish products. The levy also has been extended to include imported fish meal, and fresh and processed shellfish. The levy's purpose is to expand and diversify further WFA's current services to the white fish industry.

New Regulations

The WFA levy was increased from 1.0d. to 1.2d. per stone of white fish landed or imported. (1d. = 1 US¢; 1 stone = 14 lbs.; 1 sh. = 12 US¢.)

The new regulations extend the levy's scope: (a) For first time, a levy is imposed on oysters, scallops (Pecten maximus and Clamys opercularis), crabs, lobsters, crawfish, nephrops, shrimps, and other edible crustaceans. Molluscs in shell, other than oysters and scallops, are exempt from levy. (b) Fish landed or imported in processed form carries a differential levy calculated by reference to the approximate whole-fish equivalent. The rates are shown below. (c) A levy of 8 shillings per ton is imposed on imported fish meal, whether manufacturered from white fish or herring; a proportion of income from this levy will be paid to Herring Industry Board. (d) The levy on white fish purchased at first hand for the manufacture of fish meal has been reduced from one cent (U.S.) to 0.12d. per stone (14 lbs.). (e) Imports of processed shellfish (frozen crab meat, peeled shrimps, shelled Norway lobsters) will be levied at rate applicable to "any white fish product not referred to above." (f) The levy does not apply to imports of canned and bottled fish.

Who Pays Levy When

The increased rate is payable by first-hand purchaser unless the seller collects levy and adds it to his sales invoice. The levy on imports is payable by first-hand purchaser, usually the importer.

UNITED KINGDOM (Contd.):

The levy is payable weekly, unless other arrangements have been made. Payment is due 7 days after end of week in which fish were purchased. (U.S. Embassy, London, Feb. 11.)

The new rates of levy are:

	Rate Per Stone
FISH LANDED WHOLE OR GUTTED & WHOLE SHELLFISH	1.2d
DIFFERENTIAL LEVIES	
Fresh Frozen and Chilled White Fish:	
Headless & gutted	1.6d
Fillets, skin on	2.4d
Fillets, skinless	3.0d
Smoked White Fish:	
Headless and gutted	2.0d
Fillets, skin on	3.0d
Fillets, skinless	3.2d
Salted and Cured White Fish:	
Wet	2.4d
Dried	3.6d
Fish Meal	0.6d
White Fish Sold at First Hand for Fish-Meal Production	0.12d
Any White Fish Product Not Referred to Above	2.4d

ICELAND

JOINS EFTA

Iceland will join EFTA sometime in 1970 and come under all EFTA trade and tariff policies. On Jan. 1, 1970, she gained the same access to British market for frozen fishery products as other Nordic countries. On same date, Britain lifted all import restrictions on frozen fish in return for a minimum price system--increasing prices about 10%.

LATIN AMERICA

PERU

FISH-MEAL PRODUCTION AND EXPORTS ARE HIGH

Peruvian fish-meal production in Jan. 1970 set a record for Jan. It followed the excellent (a record) Dec. 1969 production.

Exports continued high. Stocks on hand, Feb. 1, 1970, were exceeded for that date only in 1967 and 1968.

Preliminary reports show high production (about 180,000 metric tons) for early Feb., although final figures have not been issued. (Fishery closed for 4 weeks on Feb. 14.)

Whether fishing would be as good when "veda," or closed season, ended on Mar. 16 remained to be seen.

Fish-Meal Production & Exports, Jan. 1968-70

	1970	1969	1968
		(Metric Tons)	
Production:			
Jan.	362,869	240,495	284,021
Exports:			
Jan.	173,404	140,283	192,056
Stocks on hand Feb. 1:	493,577	487,348	688,943

The current excellent fishing has given the industry a much-needed boost. (Sociedad Nacional de Pesqueria, Feb. 26.)

* * *

WORLD'S LARGEST STICKWATER MACHINERY BUILT FOR PERU

The Norwegian engineering concern, Bergs Maskin A/S, Trondheim, has produced the world's largest manufacturing unit for stickwater for a Peruvian company. The machinery, valued at US$2 million, will be installed by Bergs. Two similar but smaller stickwater machines are being produced at Bergs for other Peruvian firms. (Export Council of Norway, Feb. 1970.)

In Indonesia, breeding fish involves 200,000 Javanese. Fish and rice are staple diet. FAO encourages raising fish in ponds. (Photo: UNations)

ASIA

JAPAN

"INVISIBLE" NET CATCHES MORE FISH

Fishermen in Japan and other countries are increasing their use of "invisible" nets. The nets are transparent nylon strand that is virtually invisible under water. Fish swim blindly into the net and become entangled.

The nets are so effective that almost all gillnet fishing in Japan is now done with them. Because they are so effective, they are banned in areas such as the salmon fisheries of Canada, where there is a serious need for conservation.

The Japanese also use "invisible" nets for trawling, especially in inshore waters where light penetrates to the bottom. The wings of the trawls are made of more visible material which deflects the fish into the transparent after body and codend where they are trapped.

Use of the nets was reported by Hilmar Kristjonsson, FAO fishing technologist, who recently visited the Far East to stimulate interest in FAO's world fishing conference in Reykjavik, Iceland, May 24 to 30.

His Report

Kristjonsson said: "In Japan, which produces about half of all the netting used in world fisheries, virtually all gillnets are now made of this material. It consists of a wire-like nylon monofilament which, because of its transparency, has proved far more effective in catching fish than the traditional twine.

"More than a decade ago, transparent nylon monofilaments, like those used by anglers, were used in some commercial gillnet fisheries but mainly in lakes. Recently there has been an almost 100 percent changeover to this invisible material in marine gillnetting in Japan."

Kristjonsson foresaw great possibilities in the use of such nets, particularly with low-powered fishing boats in clear tropical waters of developing countries at coastal depths of 5 to 20 fathoms. Small boats are very important to countries like India. There, the mechanized fishing fleet consists of about 7,000 vessels 30 to 36 feet long. In India, Kristjonsson said, "it will be interesting to test the effectiveness of monofilament trawl nets as compared with the twine nets used now in these countries."

Small Net Invisibility

He noted that net visibility generally is more important when fishing with small rather than large trawl nets. It is likely that nets with "invisible" sections may also be important to industrialized fisheries, especially in shallow grounds and in midwater.

These and other developments will be discussed at the FAO Technical Conference on Fish Finding, Purse Seining, and Aimed Trawling.

* * *

FISHERIES AGENCY BUDGET INCREASED FOR FISCAL 1970

The Fisheries Agency budget for fiscal year (FY) 1970 (Apr. 1970-Mar. 1971) surpassed the US$100 million mark for the first time. It is about US$112.8 million, 22% over FY 1969's $92.4 million. It includes large increases in funding for fishing-port improvements; shallow-water fishing development; and biological research. The latter relates to international fisheries, such as North Pacific Alaska pollock and crab fisheries.

Overseas Developments

Overseas fishery development will include saury surveys by 350- and 530-ton exploratory vessels; bottomfish surveys off New

Program	Proposed FY 1970 Budget	FY 1969 Budget
	(in Millions US$)	
Fishing-port improvements	60.11	48.16
Shallow-water fishery development	0.71	0.09
Overseas fishery development	2.27	1.96
Biological research relating to international fisheries	0.65	0.53
Marine resources conservation and cultivation	1.69	1.53
Coastal fishery structural reorganization	3.84	4.34
Improvement of fishery disaster compensation system	6.40	2.79
Experimental undersea fish culture	0.19	0

JAPAN (Contd.):

Zealand and west Africa; and exploratory tuna longlining in the high latitudes of the South Pacific. ('Suisan Keizai Shimbun,' Feb. 3.)

* * *

COASTAL FISHERIES HURT BY SOVIET AND SOUTH KOREAN VESSELS

Since early Feb. 1970, Japanese octopus fishermen off Hokkaido's Pacific coast (8-11 miles off Shiranuka) have suffered substantial damage from one 300-ton South Korean (ROK) and 2 Soviet fishing vessels trawling in an area banned to Japanese trawlers.

Gear Damaged

Reportedly, the Soviet vessels came close to the Japanese territorial limit (3 miles) and badly damaged coastal octopus fishing gear. The damage was estimated at about US$30,000. The Japanese fishery cooperative is demanding compensation from the Soviets via the Japanese Foreign Office.

Soviet Bombing Exercises

An additional irritant: The Soviet Union informed Japan of 2-week bombing exercises on the high seas off Iturup Island (South Kuril Islands) beginning Mar. 1. The area is a Japanese cod fishing ground; its season usually opens prior to Mar. 1. ('Asahi Evening News,' Feb. 13.)

* * *

TUNA SEINING IN EASTERN PACIFIC IS POOR

The seiner 'Hakuryu Maru No. 55' (500 gross tons), the only Japanese seiner in the eastern tropical tuna fishery since the season began January 1970, caught only about 35 tons of yellowfin by late February. Because the vessel must catch 1,000 tons to cover expenses, its catch so far has been disappointing.

2 Unsuccessful Years

The vessel experienced two bad years in the fishery. So this year she is using three speed boats, like those used by U. S. seiners in pursuing porpoise-associated yellowfin schools. However, unsatisfactory radio communication between speed boats and mothership is hampering coordination of operations. ('Shin Suisan Shimbun Sokuho', Feb. 25.)

* * *

WILL EXPORT ALASKA POLLOCK TO U.S.

The Federation of Hokkaido Fishery Cooperative Associations is planning to export frozen Alaska pollock fillets to the U.S. Initially the Federation plans to sell around 500 tons. If a steady trade can be built up, it hopes to increase shipments to around 4,000 tons.

Trial Shipment Made

Sales negotiations began in October 1969, when the president of a U.S. firm visited Hokkaido to study Japanese fillet processing. This resulted in a 5-ton trial shipment to the U.S. for quality evaluation and to determine U.S. consumer reaction.

May Open New Market

The planned shipment is attracting attention in Japan as opening a new market. The Japanese use Alaska pollock primarily for 'surimi' (minced fish meat) for use in 'kamaboko.' ('Suisancho Nippo,' Feb. 7.)

* * *

MAY BUY SEA URCHIN FROM AUSTRALIA

A leading Japanese sea-urchin paste manufacturer is investigating the possibility of importing sea urchin roe from Australia because of the supply shortage. Sea urchin, abundant along the coast of Australia, are not harvested.

The Japanese company recently obtained samples from Australia and found them comparable in quality to imports from South Korea, North Korea, Taiwan, and Okinawa.

May Begin Importing

If first-stage processing (removing the shells) can be performed in Australia, the Japanese firm hopes to begin importing around US$28,000 worth a month.

In 1969, three major sea-urchin processors in Shimonoseki imported in 6 months a combined monthly average of around $83,000 worth. ('Minato Shimbun,' Feb. 11.)

* * *

JAPAN (Contd.):

JAPAN AND KENYA TO BUILD JOINT COLD STORAGE

Japan's Taiyo Fishing Co. and Ataka Industries, with the government of Kenya and a local fishing company, plan to build a 2,000-ton capacity cold-storage in Mombasa. Half the financing will come from the government of Kenya; the other half will be shared equally by the 3 companies. Construction was scheduled to begin in February 1970. Completion is scheduled for October. The plant will store tuna for Taiyo, and other fish for the local market.

Taiyo already operates a fishing base at Mombasa. It buys tuna from South Korean and Taiwanese longliners for export to Italy and other countries. ('Katsuo-maguro Tsushin,' Feb. 6.)

* * *

EXPORTS OF CANNED TUNA WENT UP IN 1969

Japanese canned-tuna exports in 1969 were 64,489.3 metric tons worth US$65.8 million. In standard cases of 48 7-oz. cans, this was about 6.72 million cases, a 9% increase over 1968 exports of 6.14 million cases.

Exports of canned-tuna-in-brine in 1969 surpassed the 3-million case level for the first time. ('Suisan Tsushin,' Feb. 19.)

* * *

EXPORTS OF FROZEN TUNA DOWN SHARPLY, OTHER FISH ROSE IN 1969

In 1969, Japanese frozen-tuna exports were 65,280 metric tons worth US$27.46 million. These were down about 40% in quantity and 33% in value from 1968 exports of 197,000 tons worth $41.06 million.

Tuna exports peaked at 177,000 tons in 1966, declined to 107,000 tons in 1967 and 1968, and dipped sharply in 1969. This one-time earnings leader of all fishery and agricultural products dropped from top place.

Yellowfin Fell Far

By species, yellowfin declined drastically as reflected in the sharply reduced shipments to Italy. Italy, a major importer, uses an estimated 40,000-45,000 tons of raw tuna a year. She is becoming a very important market for Taiwan, South Korea, and the U.S.

Saury Exports Continue Rise

The 1969 exports of other fishery products show saury up with 16,171 tons; this compares with 14,367 tons in 1968, and 13,000 tons in 1967. Saury exports are rising steadily despite poor catches in recent years.

The 1969 average export price for frozen saury was $460 a metric ton, over 50% above the 1968 average price of $305 a ton.

Seed oyster exports totaled 2,672 tons, including 2,238 tons sold to the U.S., 321 tons to South Korea, 102 tons to France, and 8 tons to Spain. Previously, they were exported almost entirely to the U.S. which, in 1968, took 1,858 tons. ('Suisan Tsushin,' Feb. 18.)

* * *

PET-FOOD TUNA EXPORTS DOWN IN APR.-NOV. 1969

Canned pet-food tuna exports totaled 504,026 cases Apr.-Nov. 1969, 200,000 fewer than same period 1968 (707,726 cases). The decline was attributed to short supplies of raw material and increased production in the U.S. The U.S. imported almost 90% of the 1969 exports. ('Katsuo-maguro Tsushin,' Feb. 10.)

Canned Pet Food Tuna Exports, Apr.-Nov. 1969

	Can and Case Size	
	6-oz. 48's	1-lb. tall 24's
	(No. of Cases)	
U. S.	440,317	10,500
Canada	50,609	-
Netherlands	2,500	-
Belgium	100	-
Total	493,526	10,500

* * *

IMPORTS OF FROZEN SHRIMP ROSE SHARPLY IN 1969

Japanese imports of frozen shrimp in 1969 reached 48,886 metric tons worth about US$121.75 million. This is an increase of nearly 39% in volume and 56% in value from 1968 imports of 35,204 tons worth $78.06 million.

JAPAN (Contd.):

Since Japan liberalized her shrimp imports in 1961, these began to rise steadily until 1968. Then they declined for first time due largely to drastically reduced shipments from the Soviet Union.

1969 Imports Up Sharply

In 1969, imports rose sharply--a recent high in volume and value. This resulted from continued imports particularly during second-half 1969, despite domestic oversupply, which disrupted shrimp market. Firms that had purchase arrangements with foreign suppliers had to buy regardless of Japanese demand. ('Suisan Tsushin,' Feb. 14, & 'Nihon Suisan Shimbun,' Jan. 7.)

* * *

CANNED-MACKEREL EXPORT PRICE TO U. S. DROPS

Japanese prices for canned-mackerel exports to the U.S. declined in early Feb. 1970 to around c. & f. US$6.10 a case (48 1-pound tall cans); the mid-Jan. price was around $6.30 a case. The drop was attributed primarily to softening of Philippine market, the biggest, and in other southeast Asian countries.

Another contributing factor were foreign customers who, anticipating further price decline, did not buy. They were aware of reports Japanese packers and trading firms were carrying large unsold stocks. The export outlook appeared gloomy because the mackerel packers were in full production.

5 Million Cans

Canned-mackerel exports during Jan.-Dec. 1969 by 21 member firms of the Japan Canned Food Exporters Association were about five million cases. The trading firms Mitsui, Mitsubishi, and Taiyo handled over 50% of exports; the rest were sold mostly by Nozaki, Marubeni, C. Itoh & Co., and Kansmatsu. ('Kanzume Tokuho,' Feb. 9, 'Suisan Tsushin,' Feb. 9, and 'Katsuo-maguro Tsushin,' Feb. 4.)

* * *

EXPORTS OF CANNED MACKEREL TO U.S. ARE GROWING

Japanese exports of canned mackerel to the U.S. in 1969 totaled 395,000 cases (1-lb. tall 48's) of natural pack. The U.S. is Japan's second largest market, next to the Philippines; in 1969, the latter took 1.15 million cases of natural pack. This was 40% of about 3 million cases of that style pack. Canned mackerel exports to the U.S. began growing around 1967, when U.S. packers were the principal buyers.

Private Brands Promoted

In recent years, major firms have been promoting their own brands in the U.S.; these sales now exceed quantity sold to U.S. packers. The outlook for mackerel exports to the U.S. is of steady increase. ('Suisan Tsushin,' Mar. 6 & Feb. 20.)

* * *

MAY SELL MACKEREL PET FOOD TO CANADA

The Japanese Northern District Purse Seine Fishery Assoc. expects to export canned mackerel pet food to Canada. This would be the first time the Japanese have used mackerel in pet food; normally the dark meat of tuna is used.

The product was developed by the Aomori Prefectural Marine Products Research Institute, at the Association's request, to help stabilize mackerel prices in Japan.

Sample Favorably Received

The sample product was sent to Canada, where it was favorably received. A Canadian importing firm was sending a buyer to Japan to sign a purchase contract. ('Minato Shimbun,' Feb. 21.)

* * *

JAPAN (Contd.):

SAURY FISHERY PLANNED OFF U.S. WEST COAST

About 10 large and small Japanese firms have indicated a desire to fish saury experimentally off U.S. west coast in 1970. Many more are reported interested. License applications may involve 30 vessels.

Some independent vessel owners want to operate with the big firms. Some coastal saury operators want to go it alone. Most major firms hope to conduct independent or two-boat operations; at least one firm plans to send a mothership accompanied by several vessels.

The Fisheries Agency is studying licensing policy. Reportedly, it does not plan to restrict number of vessels if these are only 15 to 20. However, its decision will depend on attitude of coastal saury operators.

1969 Operation

The 1969 Japanese saury catch off the U.S. west coast by six exploratory vessels was about 460 metric tons. The saury operations were east of 124° W. longitude from Sept. 23 until late Nov. Medium and small saury were abundant between 40° N.-45° N. latitudes; small fish ran heavy north of 44° N. latitude.

Good catches were made between 40° N.-43° N. latitudes, where medium fish were mixed with small. Saury were concentrated in areas with well-defined current boundaries located not very far from shore. Conditions relating to seaward and north-south migrations are unknown; the relationship between fishing season and fish concentrations could not be established.

Narrow & Light Weight

The eastern Pacific saury had many parasites. Their bodies were narrow and light in weight--considering their length. From early Oct., stormy weather persisted. ('Shin Suisan Shimbun Sokuho' and 'Suisan Tsushin,' Mar. 3.)

SOUTH KOREA

1969 CATCH WAS 98% OF GOAL

The Republic of Korea's 1969 catch totaled 858,000 metric tons, 98% of the goal set early in the year. The coastal catch was 534,000 tons; offshore, 158,000 tons; fish culture, 85,000 tons; and distant water fishery, 81,000. ('Suisancho Nippo,' Jan. 31.)

Growth Rate Slowing

South Korea's catch has grown rapidly during the last 4 years: from 701,000 metric tons in 1966, it increased over 20% in 1969. However, the growth rate is beginning to slow. It was 6.8% in 1967 (749,000 tons), 12.3% in 1968 (841,000 tons), and only a little over 2% in 1969.

* * *

KOREAN & TAIWANESE TUNA FLEETS GROW STRONGER

In January 1970, Taiwan had about 80 tuna vessels in the Atlantic Ocean and the Republic of Korea (S. Korea) around 70. Together, they had almost four times as many vessels in the Atlantic as Japan (40 longliners). Their operations extended from north of the equator to off Brazil. Most of the vessels concentrated on albacore.

In January 1970, there were 60 Taiwanese, 50 South Korean, and only 3 Japanese long liners operating out of American Samoa. ('Suisancho Nippo,' Jan. 22, 1970.)

Dominate American Samoa Scene

In November 1969, the Korean tuna fleet out of American Samoa had 73 long liners. Taiwan had 58 long liners, and Japan only 7. The Japanese are steadily withdrawing their long liners because of smaller profits. ('Katsuo-maguro Tsushin,' Dec. 4, 1969.)

MID EAST

UNITED ARAB REPUBLIC

FISHERIES AFFECTED BY ASWAN DAM

Partly because of the Aswan Dam, United Arab Republic (UAR) fishery catches have declined steadily since 1964. This is disclosed in a report by FAO's General Fisheries Council of the Mediterranean: 'GFCM Studies and Reviews, No. 43, Marine Resources of the United Arab Republic.'

It covers the years up to 1967. It notes that catches of marine and freshwater fish increased from about 52,000 metric tons in 1952 to about 125,000 tons in 1962. Over the next 5 years, average annual total was about 106,000 tons.

Catches Drop After 1964

After the Aswan High Dam became operational in 1964, catches began to drop along the northern coast. Sardine catches that previously averaged 15,000 tons a year decreased to 4,600 tons in 1965, and to 554 in 1966. Total UAR catches reached a record 135,000 tons in 1964, declined to 102,400 tons in 1965, and dropped to 85,000 in 1967.

Decreased Water Fertility

The report attributes the decline to the dam. In checking the periodic Nile floods, the dam reduced the flow of water rich in natural fertilizers--phosphates, nitrates, and other nutrients--into the Mediterranean. The coastal fisheries, especially sardine, had thrived on these. The lowered water fertility discouraged fish concentrations and migrations in the area.

Increased Erosion and Salinity

The report recognizes the dam's value in providing water for power, irrigation, and in flood-control. But it emphasizes the need for a close watch on the ecological and physical changes dam has caused. These include increasing salination of the delta's coastal (and eventually lake) waters, and increased coastal erosion. The Nile used to counteract this erosion by depositing 140 million tons of mud and silt a year in the area. The dam has greatly reduced this natural action.

Other factors contributing to reduced catches are growing water pollution (industry and tankers), overfishing, use of prohibited gear and small-mesh nets, and reclamation of lakes for agricultural purposes.

The Future

However, the report is optimistic about future development. It describes the 'vast' fishery potential of Lake Nasser. When fully realized, the lake will flood 4,200 square kilometers of UAR and Sudanese territory. FAO already has begun a 5-year, US$2,684,000 project to develop fishery, forestry, water, and other resources.

Inland & Distant-Water Fisheries

The report also recommends development of inland fisheries elsewhere in the country, particularly in the northern lakes. Salt-water fish have been introduced successfully in these lakes to meet their already increased salinity. The possibility of speeding development of a high-seas fleet to fish in international waters is cited.

Coastal Fisheries

It urges wider exploitation of the northern Continental Shelf, where fishing now tends to hug a narrow area between Alexandria and Port Said. The flat, muddy bottom offers excellent trawling possibilities, especially for shrimp. Other recommendations are: development of Red Sea's fisheries, especially for shark-liver oil, fish meal, and shellfish; improved fishery education and training; more marine biological research; and water-pollution control.

The report emphasizes the need for increasing protein production in the UAR. Annual per-capita consumption of animal protein is now only 10 kilograms (22 lbs.). The population of 30 million is expected to double by the year 2000.

AFRICA

SOUTH AFRICA

IMPROVES FISHING FLEET

The 1970 fishing season opened in South Africa on January 1; in South-West Africa, on February 1. In South Africa, the January catch was 41,000 short tons of fish; it was 69,000 tons in January 1969. Weather improves in February and fishing was expected to be better.

9 New Steel Vessels

This year the fishing fleet was strengthened by nine steel purse seiners, 100 to 120 feet long. (The largest wood vessel is only 85 feet long.)

Seven of the steel vessels were purchased in Norway, and two in Iceland. These vessels are faster, more comfortable, and have refrigeration. All will be used for the Walvis Bay factories, or fish for the factoryships.

Spotter Aircraft Added

Also, a new spotter aircraft was obtained: a twin-engined, short-take-off-and-landing aircraft (STOL). It can cruise from 40 to 200 miles an hour. It flies at night at about 700 feet to help locate fish schools, which appear as readily identifiable luminous patches. ('Cape Times,' Feb. 21.)

* * *

IMPROVES FISHING HARBORS

To provide better facilities for a rapidly growing fleet, South Africa's Fisheries Development Corporation is spending US$15.4 million on fishing-harbor extensions, according to the 'South African Financial Gazette'.

The work, underway or just completed, is being done at seven fishing ports along South Africa's coast.

The 7 Harbors

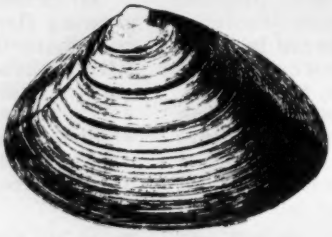
The biggest project is at Gansbaai, where $4.9 million is being spent. Construction of a new breakwater and quay will ultimately increase the little port's berthing capacity by about 50%.

Expenditure at Saldanha Bay is $3.5 million and includes reclamation work, a new quay, a 1,200-ton slipway, and a new crayfishing jetty. This project will be completed around mid-1970.

The corporation is spending $3.5 million on construction of a new breakwater, slipway, and coaster berth at St. Helena Bay, further up the west coast.

The corporation also is financing extensions worth $1.9 million at Hout Bay, $1.5 million at the Berg River mouth, $322,000 at Hermanus, and $280,000 at Lamberts Bay.

FOOD FISH FACTS



Surf Clam
(Spisula solidissima)

The name "clam" covers a wide variety of bivalve mollusks found along the coastlines of the United States. For thousands of years Indians utilized clams as food and used the shells of some species as decorations and as wampum. Early settlers in America soon found ways to enjoy these tasty gifts from the sea which were free-for-the-taking. Today clams are more popular than ever and the fishery has increased enormously in the past two decades. In 1967 the fishery yielded 71.5 million pounds of meats as compared to 39.6 million pounds in 1950. Surf clams accounted for over 45 million pounds of the total catch.

DESCRIPTION

The bivalve shells which encase the clam's body are joined together at the back by a hinge ligament which is usually visible from the outside. The shells, while varying in shape, are composed of three layers. The outer layer is often varnishlike; the thick middle layer is somewhat chalky; and the inner layer, which is usually hard, is often iridescent or lustrous in some species. Concentric rings are laid down on the shells as the clam grows. Some species have ridges which radiate from the hinge to the edge of the shell. Colors of the shell vary as they are affected by the habitat.

The two most prominent features of the clam's body are the foot or adductor muscle and the siphon or "neck." The muscular foot aids the clam in digging up or down in the soft sand or mud as well as in the opening and closing of the valves. The retractable siphon is a tube-like extension which conducts water in and out of the clam. In some species the siphon consists of two tubes. The incoming water brings food and oxygen to the clam; the outgoing water carries waste products and, during spawning, the eggs or sperm.

Along the Atlantic coast the three species which rank highest in commercial importance are:

The hard clams (Venus mercenaria) are known locally as quahogs. These clams are the most valuable of the three. Littlenecks and cherrystones are trade names for smaller-sized hard clams.

The surf clams (Spisula solidissima) are also known as skimmer, beach, giant, sea, hen, or bar clams. This species makes up the largest volume caught along Atlantic shores, but is not as valuable as the hard or soft-shell clams. Canned clams are practically all surf clams.

The soft-shell clams (Mya arenaria) are known in the Chesapeake Bay area as "mannynose." These popular clams, unlike the hard and surf clams, have elongated shells that are very thin and brittle. The soft-shell clams cannot close tightly because their long necks extend beyond the shells.

(Continued following page.)

Pacific coast clams accounted for nearly 600 thousands pounds taken commercially in 1967. Pacific coast clams include:

The razor clams (Siliqua patula); butter clams (Saxidomus nuttalli) and (Saxidomus giganteus); littleneck clams (Protothaca staminea); the Atlantic softshell clams (Mya arenaria) which have been transplanted; and the geoducks (Panope generosa) which may become commercially important with new beds discovered off the coast of Washington State.

HABITAT

Clams are found in subtidal or intertidal zones of beaches and mud flats out to depths of over 30 fathoms. Some live in quiet waters along the bottoms of protected bays, inlets, and sounds while others prefer sandy beaches on the open coast. Clams are usually buried in the bottom from just under the bottom surface to depths of over 4 feet, depending on the species. Atlantic clams range along coastlines of New England, the Middle Atlantic States, Chesapeake Bay, and some are found along South Atlantic shores. Pacific clams are found all along the coast with the largest commercial production in Washington.

HARVESTING CLAMS

Commercial harvesting of clams employs approximately 11,700 persons. These fishermen utilize around 346 vessels of 5 net tons or more and about 5,600 boats. Many of the boats or vessels are equipped with electronic depth recorders and hydraulic escalator dredges which are pushed along the bottom. The clams are loosened from the bottom with a high-pressure water spray, scooped onto a chain-mesh belt, carried up to the boat, and sorted by the crew. Commercially sized clams are retained, all debris and small clams fall back into the water. Fishing is restricted to certain areas and most dredges have a daily quota. Clam dredges are not used as extensively for commercial purposes on the Pacific coast as they are on the Atlantic coast. Other methods of taking clams include tongs, rakes, forks, shovels, or by hand.

CONSERVATION AND MANAGEMENT

Many factors, some beyond man's control, affect the abundance of clams. However, it is well known that pesticides; pollutants such as fuel oil, gasoline, and other liquid petroleum products; and the dumping of industrial wastes can and do destroy or otherwise damage this valuable resource. In most States special fishery agencies have been established to enforce laws and protect supplies of fishery products. The Bureau of Commercial Fisheries is making extensive studies of the occurrence and effects of pesticides and pollutants on shellfish.

Recent advances in techniques at the Bureau of Commercial Fisheries Laboratory in Milford, Connecticut, show that commercial propagation of clams may soon be feasible as well as profitable. The Washington State Laboratories at Brinnon, Washington have also done considerable study in the cultivation of clams. Within the next few years clam farming may be a new and profitable venture.

USES OF CLAMS

Clams, one of our most delicious shellfish, are high in protein, contain some calcium and iron, and have no fat. Fresh clams may be purchased alive in the shell; shucked; or shucked and quick frozen. Live clams in the shell should be tightly closed. Canned whole shucked meats; minced meats; bottled clam juice; and many frozen clam specialties are also available. Clams may be used in a variety of ways including a clambake; steamed-in-the-shell; broiled-on-the-half-shell; in chowders, fritters, sauces, dips, salads, or canapes; fried; or combined with other foods. (Source: National Marketing Services Office, BCF, U.S. Department of the Interior, 100 East Ohio Street, Rm. 526, Chicago, Illinois 60611.)

SOUPS AND SANDWICHES BEGIN WITH SEAFOODS

Here's a meal that was made for flavorful family enjoyment. Serve Saucy Sandwiches and Savory Chowder, and watch everyone from Junior to Grandpa dig in. You won't need to be a French chef to set this combination aglow with goodness; it sells itself with built-in helpings of heartiness.

Seafood is a favorite of the younger set, and they will quickly tackle this Saucy Sandwich, made with inspected fish portions. Its crisp fresh freshness is topped tantalizingly with an easy-to-do combination of cheese, chili sauce, mustard, and horseradish that will set taste buds a-tingling. Its familiar wholesomeness will appeal to the youngsters, who want plenty of good food without frills and who usually want it in a hurry. Be at your alert best with this high-protein sandwich.

Complete the meal with Savory Chowder. Your family's appetite will rise to the occasion when you place a steaming pot of chowder on the table. It is highly nutritious, based on tender minced clams, with bits of bacon, onion, celery, potatoes, carrots, and butter included to help balance the daily diet.

You won't need a dinner bell to call a hungry crew to this meal. Junior will even leave the television before the end of the program to get his share of this tasty duo. Who could blame him if he forgets to comb his hair? His thoughts are already seated at the table. Dad's newspaper will stop rustling the minute chowder flavors drift past his nose.

So break out the ingredients for these tasty sea treats, and you will soon be queen of a crowded kitchen.

SAVORY CHOWDER

- 3 cans (7½ or 8 ounces each) minced clams
- 3 cups milk
- ½ cup crushed saltines
- ¼ cup chopped bacon
- ½ cup chopped onion
- ¼ cup chopped celery
- 1 cup clam liquor
- 1 cup diced potatoes
- ½ cup sliced carrots
- 1 small bay leaf
- 2 tablespoon butter or margarine
- Chopped parsley

Drain clams and reserve liquor. Combine milk and saltines. Fry bacon until crisp. Add onion and celery and cook until tender. Add clam liquor, potatoes, carrots, and bay leaf. Cover and simmer for 15 to 20 minutes or until vegetables are tender. Add butter, milk mixture, and clams. Heat. Sprinkle with parsley. Makes 6 servings.

SAUCY SANDWICH

- 1½ pounds frozen, raw, breaded fish portions
- 1 cup grated cheese
- 2 tablespoons chili sauce
- 1 tablespoon prepared mustard
- 2 teaspoons horseradish
- 6 hamburger rolls

Place frozen portions in a single layer in a frying basket. Fry in deep fat, 350° F., for 4 to 6 minutes or until brown. Drain on absorbent paper. Combine cheese, chili sauce, mustard, and horseradish. Split rolls and toast. Place the bottom half of the rolls on a cookie sheet, 15 x 12 inches. Place a fish portion on each half. Spread one tablespoon cheese mixture over each portion. Broil about 3 inches from source of heat, 2 to 3 minutes or until cheese melts. Top with second half of roll. Serves 6.

The latest methods for purchasing, handling, storing, and preparing fish are included in the new, 60-page, complete guide to fish cookery, "Let's Cook Fish." This valuable, full-color reference and recipe book is available by sending 60¢ to the Superintendent of Documents, Washington, D.C. 20240.

JAPANESE KNOW-HOW BENEFITS U. S. FISHERMEN

Food product research conducted during the past year by scientists of the BCF Technology Laboratory, Seattle, Wash., and a Japanese scientist from the Tokai Research Laboratory, Tokyo, has opened possibilities of using for food many abundant and unutilized species present in U.S. coastal waters.

The cooperative study developed from the interest of scientists at the Seattle laboratory in processing techniques used by the Japanese fishing industry. And the Japanese scientists were very interested in studying the little-used species off U.S. Pacific coast for possible import by Japanese industry. So a leading Japanese biochemist, Dr. Minoru Okada, visited the Seattle laboratory for 10 months to study the suitability of various Pacific coast fish for manufacture into food items popular in Japan. These products are fish sausage, fried fish cakes, and kamaboko--a sort of steamed fish pudding or cake.

All Edible Flesh Used

An attractive aspect of these Japanese processed foods is that all of the edible flesh from several species--including pollock, hake, rockfish, shark, and even dogfish--can be used. The flesh is ground, washed, and modified during processing to form a food that no longer resembles fish. In some cases, the resulting pudding or fish cake can be flavored and modified to taste like anything from cheese to spiced meat. Once the Seattle scientists learned techniques of changing texture as well as flavor, they were able to produce a variety of products ranging from cocktail-type spreads of different flavors to the firm elastic-gel product known as kamaboko.

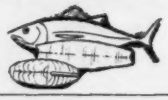
Fig. 1 - This Japanese machine separates fish flesh from skin and bones. It was put to use recently by scientists at the BCF Fisheries Technology Laboratory in Seattle, Washington. The machine was used during cooperative U.S.-Japan studies on increased use of latent Northeast Pacific fishery resources. BCF scientists believe the potential for mechanizing the process of flesh separation and recovery could lead to a new concept in fish utilization and processing in the U.S.

Fig. 2 - Technologists at the BCF Technology Laboratory in Seattle, Washington, test the textures of new products made from ground fish. Scientists can modify texture over a wide range and simulate that found in wieners, sausages, hard cheeses, and spreads. The lab designed this shear-texture instrument to produce the cutting and pressure action of the teeth in chewing various foods. The instrument registers hydraulically the jaw pressure on the dial as test samples are cut by the machine teeth.

A valuable offshoot of the cooperative research has been the opportunity for U.S. scientists to learn techniques and equipment used by the Japanese to recover separate fish flesh from skin and bones. Conventional filleting techniques used to remove meat from rockfish will yield about one-third the original fish weight. With one Japanese flesh-separating machine being tested by the laboratory, over half the weight of the whole fish can be recovered as edible flesh for processing. The laboratory staff says the economics of this increased yield and the potential for mechanizing the whole process of flesh separation and recovery can lead to a new concept in fish utilization and processing in the U.S.

What's Ahead

Much research still is needed to determine how fish should be handled, but the door has been opened to new areas of fish utilization. Dr. Okada has returned home, but the Seattle lab now has a full-time research team using the new knowledge. As the BCF scientists see it, the real future is using the new technology to exploit long-neglected species to produce processed fish foods and snack-type, high-protein items that will benefit the U.S. fisherman and consumer. (Source: National Marketing Services Office, BCF, U. S. Department of the Interior, 100 East Ohio Street, Rm. 526, Chicago, Illinois 60611.)



SEAFOOD STORAGE AND THAWING

Whether they are cooked within hours of being caught or prepared later for a family man, fish taste better when properly handled, say the seafood marketing experts of the Texas Parks and Wildlife Department.

If fish are to be stored between hooking and cooking, it must be remembered that they are perishable and should be protected against bacteria which can lead to spoilage.

Before storing fish, wash them in cold running water and then wrap in a moisture-proof, vapor-proof paper, or place in an airtight, rigid container. Fish should always be stored in the coldest part of the refrigerator since a storage temperature of 35° to 40° F. is needed to maintain the quality of the fish product. Do not hold fresh fish in the refrigerator longer than a day or two before cooking.

Commercially packaged frozen fish should remain in the unopened package and stored in a freezer which maintains 0° F. When fish is to be frozen, it should be wrapped in heavy freezer paper or placed in freezer containers. Wax paper or thin polyethylene materials are not moisture or vapor-proof and will not properly preserve the quality of the fish during freezing. When fish thaws, it should be cooked immediately. Never refreeze fish!

Freezer storage is a convenient way to keep fish; however, storage time should be limited in order to enjoy optimum flavor of the frozen fish. It is a good practice to date the packages as they are put in the freezer, and they should not be kept frozen for more than six months.

Frozen fish should be thawed in the refrigerator at 37° to 40° F. The fish should be held at this temperature only long enough to permit ease in preparation. It takes about 24 hours to thaw a one-pound package in this manner. If a quicker method is preferred, the fish, still wrapped in the moisture-proof, vapor-proof wrapping, may be held under cold running water until thawed.

INDEX

Page

UNITED STATES:

1 .. U.S. Fishermen Earned Record $518 Million in 1969
3 .. U.S. Regains 5th Place in World Fishing
3 .. BCF in Cooperative Survey for Industrial Fish in Atlantic
4 .. Skipjack & Yellowfin Tuna Schools Found Near American Samoa
5 .. Squid Slurp Is Tested Successfully
6 .. San Pedro Fleet's Financial Condition Studied
7 .. Gate Designed to Release Porpoise from Purse Seines
7 .. Fisheries Featured at Marine Technology Society Exposition
8 .. International Fisheries Survey Continues Off U.S. West Coast
9 .. U.S. Visitors Welcomed Aboard Soviet Fishery Vessel
11 .. BCF Miami Scientists Study Florida Calico Scallops, by Ann Weeks
13 .. Shrimp-Sorting Trawl in Gulf of Mexico So Far Ineffective
13 .. Longliner in Gulf of Mexico Lands 22,000 Lbs. of Swordfish
14 .. 'Delaware II' Finds Ocean Quahogs Off Southern New England
18 .. Crabs Are Serious Predators of Clams
18 .. King-Sized Clams May Be Marketed
18 .. Columbia River Smelt Promoted in Midwest
19 .. 10-Year Plan to Develop Willamette R. System Underway
19 .. Solution Sought to Salmon "Shaker" Problem
20 .. New Mesh Restriction for Steelhead Is Effective
20 .. Reports on Shrimp Separator Trawl in Oregon Are Good
20 .. Advances in Catfish Harvesting
21 .. Heavy Alewife Die-Offs Possible in Lake Michigan This Year
22 .. On the Death of Lakes
25 .. 'Commercial Fisheries Abstracts'

Oceanography:

26 .. Sea Temperatures Measured by Satellite
26 .. Organisms That Foul Vessels Can Also Detect Pollution
27 .. Scientists See Rare Marine Animal With Special Camera
28 .. New-Type Drifting Buoy Set Adrift on Georges Bank
28 .. Antarctica Once Joined to S.E. Africa, Scientists Say
28 .. Computer Used to Study World's Oceans
30 .. Extra-Hot Panama Basin of Pacific Is Studied
30 .. Deep-Sea Expedition Catches Record Fish
31 .. Dr. J. L. McHugh Appointed IDOE Coordinator
32 .. Foreign Fishing Off U.S. in February 1970

ARTICLES:

34 .. Surface Tuna Schools Located & Fished in Equatorial Eastern Pacific, by Thomas S. Hida
38 .. Night Lighting for Herring--An Old Technique May Have New Possibilities, by Alden P. Stickney
41 .. BOOKS

Page

INTERNATIONAL:

45 .. Forecast Slight Rise in Marine-Oil Output for 1970
45 .. World Fishery Trade Increased in 1968
46 .. Halibut Surveyed in Southeastern Bering Sea
46 .. Atlantic Salmon High-Seas Fishery Increased in 1969
47 .. World's First Floating FPC Factory Is Operating
49 .. FAO Masterfisherman for Developing World
50 .. 1970 Yellowfin Tuna Season in Eastern Tropical Pacific Ends
50 .. Japanese Sound out Mexicans on Joint Fishing in Mexico
50 .. Japan and Mauritania Reach Fishery Agreement

Canada:

51 .. Newfoundland's 1969 Landings Topped Billion Lbs. First Time
52 .. British Columbia's Fishing Industry Views the 1970s
52 .. Extends Ban on Hunting Baby Seals
52 .. Approves Legislation for Salt Fish Corporation

Europe:

USSR:

53 .. Plan to Expand Fish Farming
53 .. Scientists Observe Fish With Underwater TV
53 .. Underwater Film Shows Fish Can 'Learn'
54 .. Seized 39 Japanese Fishing Vessels in 1969

Norway:

54 .. Canned Fish Exports Fell in 1969
54 .. Herring Fishery on Georges Bank Is Unsuccessful
55 .. Saithe Sales to East European Market Will Set Record
55 .. New Whaling Factoryship Is Delivered
55 .. Will Purchase Floating Herring-Meal Factoryship
55 .. Shrimp Factory Shipped to Kuwait

West Germany:

56 .. Herring Fishery Develops Off U.S. Atlantic Coast

United Kingdom:

56 .. Fish Levy Increased & Extended

Iceland:

57 .. Joins EFTA

Latin America:

Peru:

57 .. Fish-Meal Production and Exports Are High
57 .. World's Largest Stickwater Machinery Built for Peru

Asia:

Japan:

59 .. "Invisible" Net Catches More Fish
59 .. Fisheries Agency Budget Increased for Fiscal 1970
60 .. Coastal Fisheries Hurt by Soviet and South Korean Vessels
60 .. Tuna Seining in Eastern Pacific Is Poor
60 .. Will Export Alaska Pollock to U.S.
60 .. May Buy Sea Urchin from Australia
61 .. Japan and Kenya to Build Joint Cold Storage
61 .. Exports of Canned Tuna Went Up in 1969

Index continued page 72.

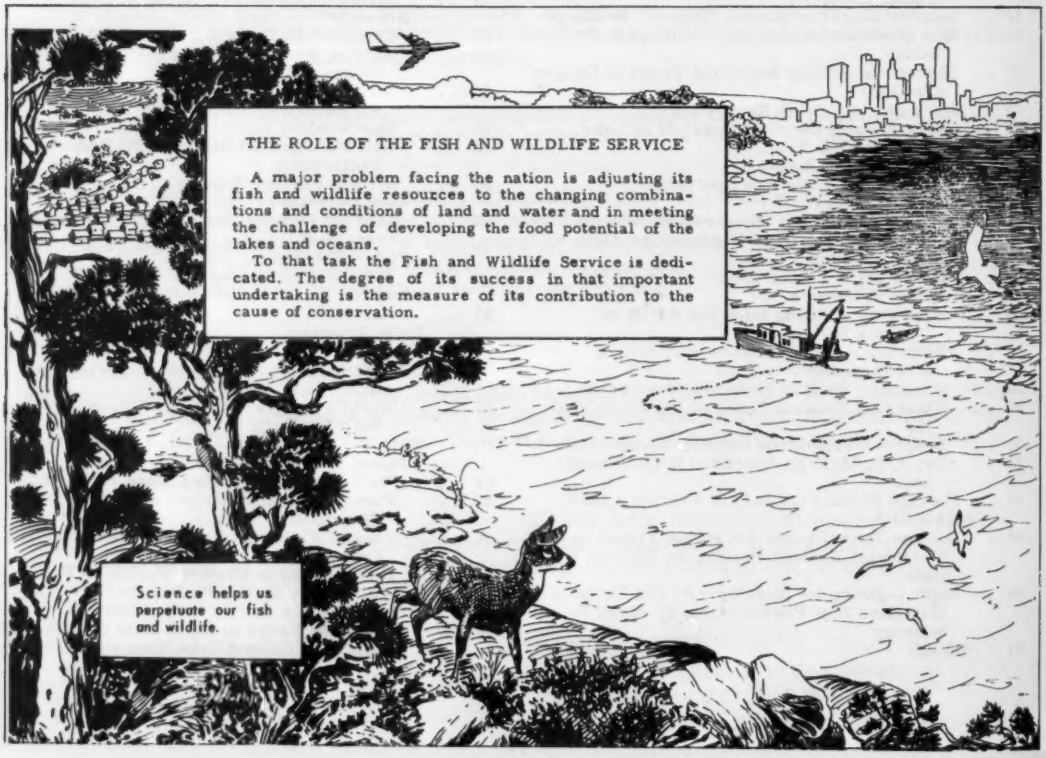
INDEX (CONTINUED)

Page

INTERNATIONAL (Contd.):
Asia (Contd.):
Japan (Contd.):
61 .. Exports of Frozen Tuna Down Sharply, Other Fish Rose in 1969
61 .. Pet-Food Tuna Exports Down in Apr.-Nov. 1969
61 .. Imports of Frozen Shrimp Rose Sharply in 1969
62 .. Canned-Mackerel Export Price to U. S. Drops
62 .. Exports of Canned Mackerel to U.S. Are Growing
62 .. May Sell Mackerel Pet Food to Canada
63 .. Saury Fishery Planned Off U.S. West Coast

Page

INTERNATIONAL (Contd.):
Asia (Contd.):
South Korea:
63 .. 1969 Catch Was 98% of Goal
63 .. Korean & Taiwanese Tuna Fleets Grow Stronger
Mid East:
United Arab Republic:
64 .. Fisheries Affected by Aswan Dam
Africa:
South Africa:
65 .. Improves Fishing Fleet
65 .. Improves Fishing Harbors
66 ..Food Fish Facts--Surf Clam
71 ..INDEX


THE ROLE OF THE FISH AND WILDLIFE SERVICE
A major problem facing the nation is adjusting its fish and wildlife resources to the changing combinations and conditions of land and water and in meeting the challenge of developing the food potential of the lakes and oceans.
To that task the Fish and Wildlife Service is dedicated. The degree of its success in that important undertaking is the measure of its contribution to the cause of conservation.
Science helps us perpetuate our fish and wildlife.

UNITED STATES DEPARTMENT OF THE INTERIOR

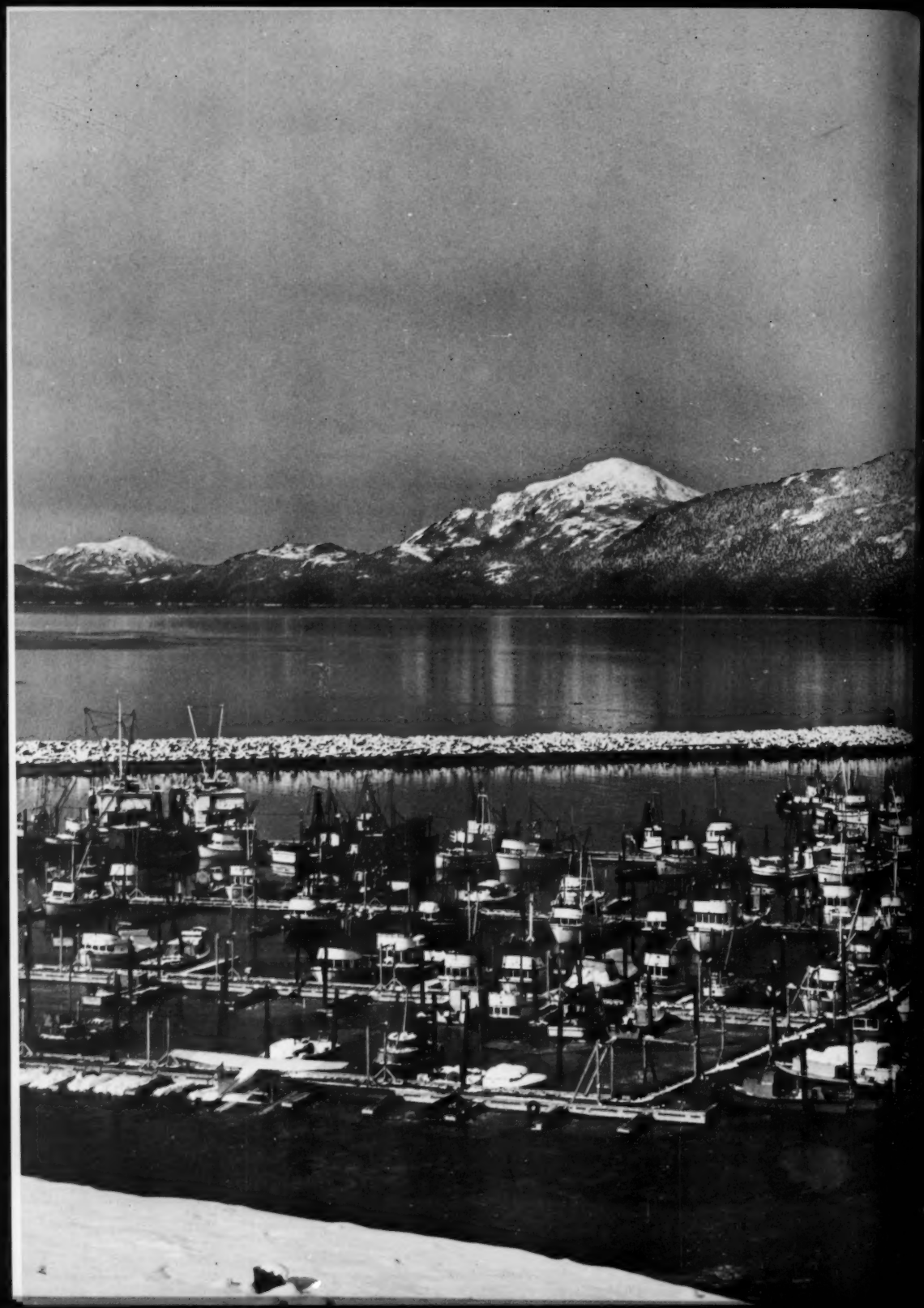
Walter J. Hickel, *Secretary*

Leslie L. Glasgow, *Assistant Secretary*
for Fish and Wildlife, Parks, and Marine Resources

Charles H. Meacham, *Commissioner*, U.S. FISH AND WILDLIFE SERVICE

Philip M. Roedel, *Director*, BUREAU OF COMMERCIAL FISHERIES

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States -- now and in the future.

BACK COVER: Home of Cordova, Alaska, fishing fleet. (Photo: J. M. Olson)